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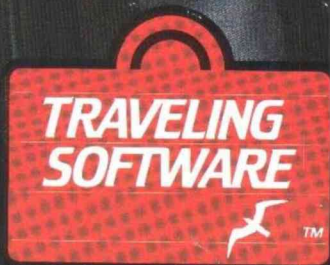


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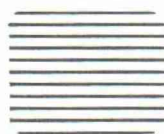
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By Richard Ramella

When Tandy released the 100, reviewers hailed the micro's graphics. Here's a chance to find out what the shouting was about.

34 RAMP UP YOUR MEWS TO 32K WITH PLUG-IN CMOS

By Scott L. Norman

Even if the inside of a computer gives you cause to shudder, you can easily add memory to your 100.

40 DISASSEMBLING THE PUZZLE IN YOUR 100'S ROM

By Jake Commander

For our readers who wish to follow in Jake's footsteps, here's an opportunity from the old disassembler himself.

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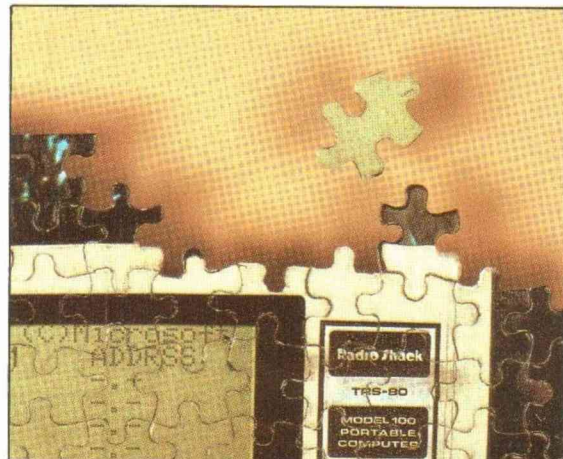
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Beat the Christmas crowds by letting your micro do your shopping.

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22 TANDYTALK

Nix bothersome carriage returns and use COMM to talk to your Mod 4.

By Bill Walters

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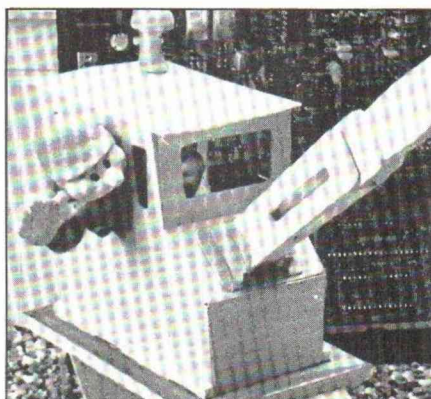
As Model 100 converts increase every day, CompuChurch gets nearer.

By Jake Commander

49 BUSCH LEAGUE

Computer assisted design "without any practical application."

By David Busch



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60 THE 100 BECOMES A SILENT BOARD MEMBER

By David Hughes

A public man uses his 100 to hold a silent meeting in the middle of a public gathering.

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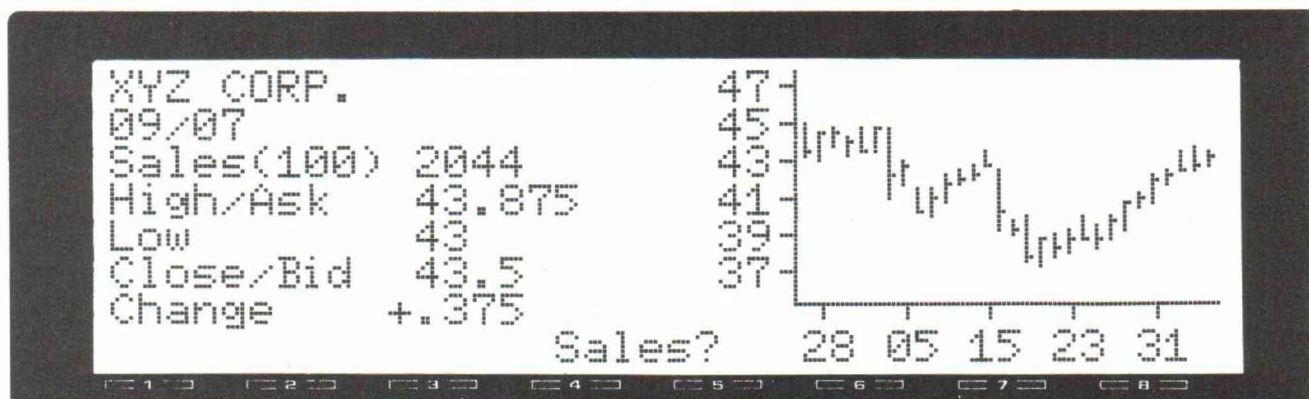
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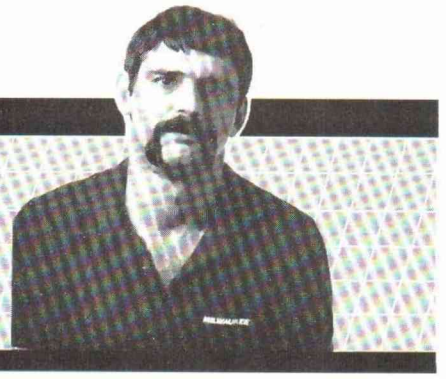
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PREVIEW



BIRTH OF A NEW FIRM, DISASSEMBLY OF A ROM, AND A RAP OF SHAKEOUT

Starting with this issue *Portable 100* will be published by Computer Communications Inc. Initially, the change, like the Model 100's operating system, will be invisible to our readers. CCI is headed up by our present publisher, Jim Povec, and our editorial and advertising staff will remain the same. But as CCI grows in the next 12 months, we believe it and *Portable 100* will be able to bring some exciting ideas to fruition with the end result benefiting not only Model 100 owners but the microcomputer industry as a whole.

SAN DIEGO. All the fabled Southern California sun seemed confined to predictions about the future of portable computers at a seminar on battery-operated and portable micros sponsored by Future Computing, Inc., the Richardson, TX, marketing and consulting firm. The rosy predictions, though, couldn't hide the industry's concern over the business media's interpretation of Adam Osborne's bankruptcy as the sign of a shakeout in the micro field (page 12).

ROM DISASSEMBLY. As many folks know, a virgin ROM is irresistible for Jake Commander, and the Model 100's was no exception. Soon after taking his mighty mite home from Fort Worth, he began writing a Basic program to reveal all the goodies the 100's programmers had stored in its inviolate memory. If you, too, want to take a gander at your 100's darkest secrets, Jake will tell you how, starting on page 40.

MORE RAM. Before the words 8K left your mouth, I'm sure you were thinking about how can I get more

memory for my 100? It didn't take long (as you can see from the ads in this magazine) for some enterprising companies to read your mind. But is it really that easy to upgrade your micro? Scott Norman (page 34) says yes. But be forewarned. Any work you do on your machine will cost you your Radio Shack warranty.

GRAPHICS GALORE. When Tandy released the 100, critics praised the machine's graphics. Two frequent contributors to *Portable 100*, David Busch and Richard Ramella, have set their sights on this area, with some enchanting results.

In Dave's Busch League column (page 49), he shows you how to create graphics with your 100, then use them in a game involving the "most expensive Etch-A-Sketch" in the world. Richard also employs Etch-A-Sketch theory in his approach to graphics (page 26); so

much so he had to warn his children not shake his 100 to erase a drawing created with his Sketch Pad.

OTHER STUFF. The ever-inventive David Hughes (*Portable 100*, September 1983, page 14) discovered a new use for his 100 when he attended a meeting of his city council. You can read about how his micro became a silent board member of his corporation on page 60.

Model 4 owners will find Bill Walters' column (page 22) particularly informative this month as he runs down, step by step, how to upload and download between the 100 and 4.

Does the thought of Christmas shopping make you say, "Bah! Humbug!"? Bill Loudon offers an alternative to the crush of holiday crowds on page 20.

And for the irreverent among our readers, Jake took some time off from his ROM ruminations to speculate on the potential interface between portable computing and religion in his essay on "CompuChurch" (page 24). ♣

A WORD ABOUT LISTINGS...

Packed program listings have been a bane for us for a long time. Granted, packing lines is necessary to make Basic run faster, but it can be hell when you're trying to figure out how a program works. For you newcomers, a program line may be made up of several program statements separated by a colon. So when you're going through a listing in *Portable 100*, keep the following in mind.

When you see a line like this:

```
830 PRINT
      :PRINTAB(2) "IT TOOK YOU ";DM;"
      MIN. AND ";DS;
```

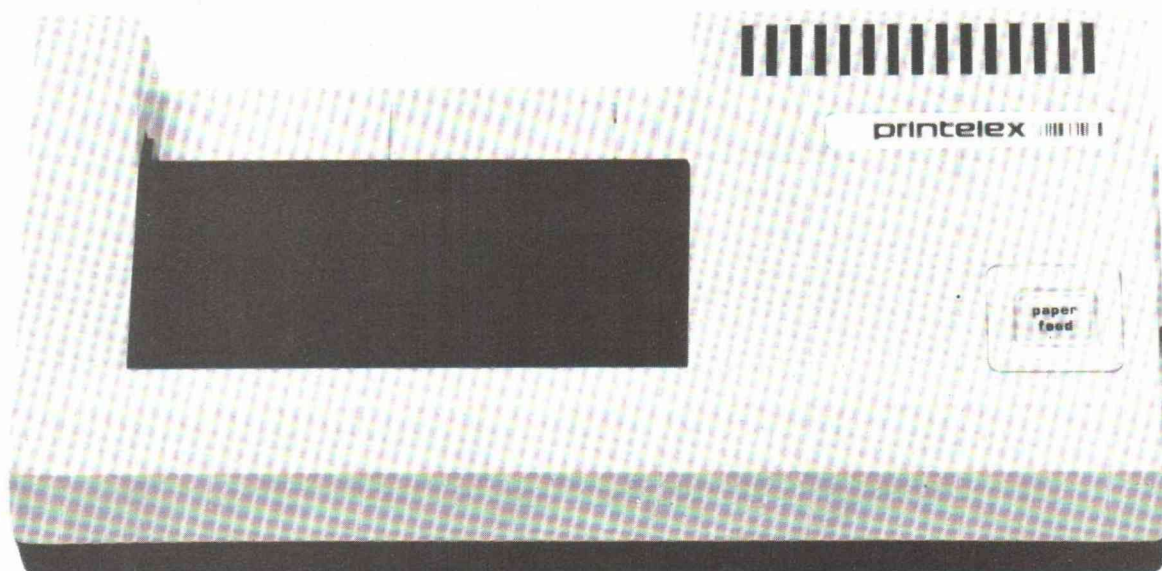
It should be typed like this:

```
830 PRINT:PRINTAB(2) "IT TOOK YOU ";DM;"MIN. AND ";DS;
```

This may be a little confusing for the novice, but you'll soon see it makes the listings easier to type into your 100 and easier to understand how the programs work.

—The Editors

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Managing Editor

John P. Mello Jr.

Production Manager

Lynn Rognsvoog

Senior Technical Editor

Curtis P. Feigel

Technical Editor

Jamie Tietjen

Contributing Editors

Jake Commander, David Busch

Terry Kepner, Bill Loudon

Bill Walters

Ad Production

J.L. Patterson

Art Production

Susan Cramer

Rod McCormick

Publisher

James S. Povec

Director of Marketing

Carl Cramer

Advertising Director

Peter K.J. Montross

(207) 236-9621

67 Elm Street

Camden, Maine 04843

Advertising Scheduler

Caron L. Taylor

Circulation Director

Lori Hellevig

Loriel Peters, Assistant

Bulk Sales

Marian Savage

Projects Director

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Controller

John Delile

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Office Manager

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Typist

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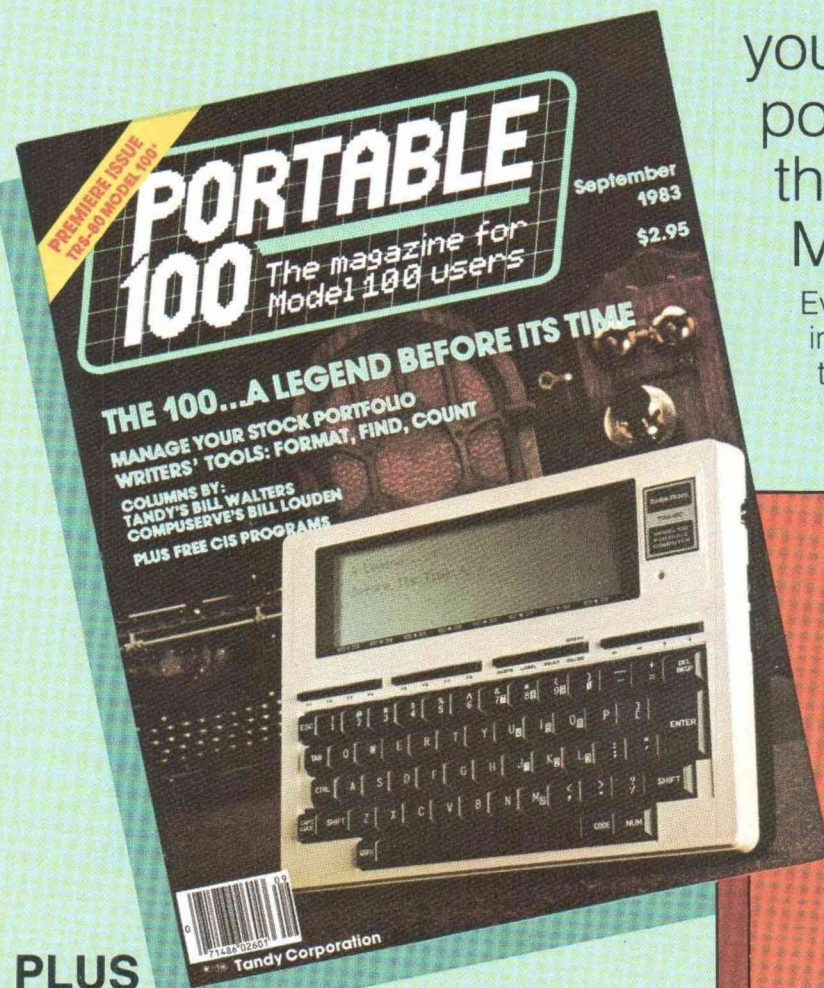


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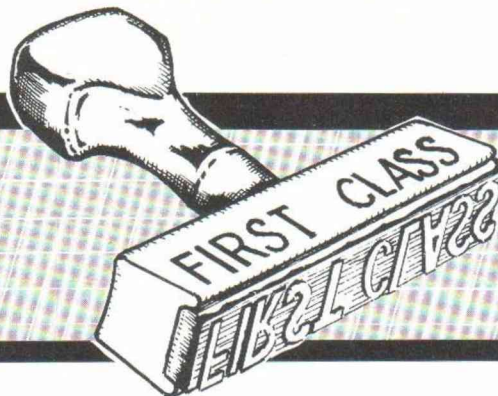
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CLEAN HEADS KEY TO CASSETTE SUCCESS

On reading my first issue of *Portable 100* magazine I noticed in the letters that many people are having trouble with the cassette tape medium. I also had many problems until I discovered the Model 100 is extremely sensitive to recorder head cleanliness. After about 10 or 15 minutes of recording (or play) time, if the heads are not cleaned I/O errors result. This was true of the CCR-81 unit, Panasonic RQ-8300, and a number of other recorders I have tried. So the moral is, keep a head cleaning kit handy and use it before a lengthy session with the recorder.

I have a feeling the cause of the problem is the very high data rate used by the Model 100. This places a high reliance on the high frequency performance of the recorder. This is not a strong characteristic of most portable recorders in the first place.

J. Kenneth Guscott
Lynnfield, MA

RAMELLA'S PROGRAM GOOD BUT COULD HAVE BEEN BETTER

I have seen your program "Text-helper" in the September issue of the *Portable 100 Magazine*. I enjoyed running it on my computer.

I found two inconvenient weak points in the program which could easily be rectified.

One, the introduction of the right and left margin at the same time

makes it very impractical for everyday operation. Quite often we need different margin widths in our documents, especially if we have already provided a mechanical left margin in the printer.

Two, lack of any sort of right hand margin justification gives the im-

pression of sloppiness to the right side of our paper.

I am enclosing a copy of a program I use for my printings (see Texthelper 2.0 in box). You will notice that in this program a simple routine has been employed to take care of the above points. In this pro-

TEXTHELPER 2.0

```
10 CRS=CHR$(13):SP$=" ":WDS=""
20 CLS
30 LC=1
40 FILES
50 PRINT @170, CHR$(27); "p"; "Text files only (.DO)
   ";CHR$(27); "q";
60 PRINT @240, "File to print: ";:INPUT FS
70 GOSUB 350:PRINT @240, "Left Margin: ";:INPUT M
80 GOSUB 350:PRINT @240, "Right Margin: ";:INPUT W
85 GOSUB 350:PRINT @240, "LINE SPACING: ";:INPUT LS
90 LPRINT TAB(M);
100 OPEN FS FOR INPUT AS 1
110 IF EOF(1) THEN 330
120 AS=INPUT$(1,1)
135 IF AS=CRS THEN 200
140 LET WDS=WDS+AS
150 LET WL=WL+1
160 IF AS=SP$ THEN 200 ELSE 110
200 IF LPOS(0) + WL <= W THEN LPRINT WDS; ELSE 400
210 LET WDS=""
220 LET WL=0
230 IF AS=CRS THEN GOSUB 600
250 IF LC<57 THEN GOTO 110 ELSE 470
330 CLOSE
340 MENU
350 PRINT @240, SPACES(40);:RETURN
400 FOR I=1 TO LS
410 IF LC >= 57 THEN GOTO 470
420 LPRINT
430 LET LC=LC+1
440 NEXT I
450 LPRINT TAB(M);
460 IF LC < 57 THEN 110
470 LC=1
480 FOR I=1 TO 10
490 LPRINT
500 NEXT I
510 LPRINT TAB(M);
520 GOTO 110
600 LPRINT AS
610 LET LC=LC+2
620 AS=INPUT$(1,1)
630 IF AS=SP$ THEN 620
640 LPRINT TAB(M);
650 RETURN
```


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gram, the arrangement for the line spacing has some merits and seems to be simpler to incorporate in formatting. But in practical usage the latter point is not of great importance, because very seldom do we need a line spacing larger than three, which your program cannot provide.

Alidad Farmanfarma
Washington, DC

ENTHRALLED, BUT IT STILL DOESN'T DO WHAT IT'S SUPPOSED TO

I was immediately attracted to the cover story of your September issue "Manage Your Stock Portfolio." Because of it I immediately subscribed to your fine magazine. All of the articles and advertisements were worth reading several times. I did, however, have some difficulty with the main article I was interested in.

As a Certified Public Accountant with several clients involved in the stock market, the article by Edwin Dethlefsen thoroughly enthralled me. When I tried to enter the program I ran into several difficulties. I first have to make the assumption that most purchasers of the Radio Shack Portable 100 are uninitiated novices in the new world of portable or desktop computers.

First, I would have found it much easier to type in the software program if it would have been written in to scale for the 100 Radio Shack. Another monthly magazine that caters to us elementary explorers does do it in a simplified manner and makes it easier for us. I could only get the program to work halfway.

Are the following errors in the software program?

- Should line 710 CLSGOSUB200 have a ":" after CLS? Should it really read as: 710 CLS:GOSUB200?
- The numbers 950 and 970 repeat twice. Should they?
- Line 1030, the first four symbols read: IFJ<. Shouldn't there be a number or a symbolic number follow the symbol "<"? To my uninitiated untrained mind there seems to be something missing between < and THEN on line 1030.

Page 4, "A Word About Listings" tells us how to properly enter the software program on page 44. Is there some way to have the program published the way it is to be entered by us desperate, software hungry mortals who don't dig program language yet?

Thanks for your time, patience, consideration, and understanding. Your patience with myself, and hopefully many others like myself (who may not want to admit their ignorance as quickly as myself) should be greatly appreciated because you will then be able to reach a much larger but less sophisticated audience that will grow in intellect and knowledge commensurate with your creative innovative compassion for those presently less knowledgeable.

Thank you for your endurance.

Rubin L. Gorewitz
New York, NY

▶ Rubin, it is us that should be thanking you for your perseverance. A corrected version of Edwin Dethlefsen's program is printed in our Black Flag department on page 48.

JPMjr.

A CAUTIOUS BUT HAPPY PORTABLE 100 READER

At last! I bought my TRS-100 in June knowing there would be a delay before software support was forthcoming, but these past three months have been long.

My Radio Shack salesman passed on the rumor of a Texas-based company which had a text formatter for sale, but 10 phone calls later (so he said) and he had no more specifics. Patient combing of computer magazines surfaced nothing until I spied the premier issue of *Portable 100*!

So you can fully appreciate my impatience, I typed, edited, and manually formatted and numbered a 70-page, single-spaced manuscript with artwork and table of contents for submission to potential publishers. While I wait for my Businesspak+, I'm going to key-in and use "Text-helper" featured in your "Format Your Words With This Text Aid" article by Richard Ramella.

Had I not been so busy counting spaces for page breaks and artwork, I might have had time to use my modem and free hour to CompuServe thus discovering the 100 SIG and aid in solving my problems.

I must admit that I saw your ads for charter subscription to a magazine devoted to the 100, and I succumbed to a sometimes cautious nature, thinking the quality might not live up to my hopes. I think you can tell from the above that I love your first issue; you have a subscriber in me!

Phyllis A. Mayo
Boston, MA

EPSON FX DIFFERENT ANIMAL THAN EPSON MX

Though I'm not highly familiar with the Epson MX printer [see "The Model 100 and the MX-80: A Powerful Duo," *Portable 100*, October 1983, page 40] I've just completed a full translation of printer operation-codes for the more recent Epson FX. From what I've read of the likeness of the two printers, perhaps you can use the following.

Underlining is indicated to the printer with Esc.-(read: escape dash) with the set being 1 and/or 49. These are decimal values and correspond respectively to Model 100 keyboard inputs of CTRL A (control-capital a) and which will show the screen figure (up caret- A) and 1 (one). The cancel function results from the input of decimal values zero and 48, which correspond to CTRL @ (up caret-@) which, unfortunately, is one of about three or four decimal values that aren't transmitted by the Model 100 even though the keyboard input is made. The second value, decimal 48, is the keyboard input 0 (zero). Your printer may require the decimal zero value which that Model 100 doesn't send!

Another possibility exists which I'm using for all my embedding of printer control-codes (which avoids some significant problems that occur from using the CTRL-P sequences and the SAVE LPT sequence described on the bottom of the manual's page 60. If you do use these remember that each code entry-digit or letter must be pre-

ceeded by its own CTRL-P entry. But even then the loss of certain formatting in the required SAVE LPT mode makes it undesirable.

There is the possibility that the printer actually uses only the last seven significant digits of an eight-bit binary number thus binary 00000001 and 10000001 are read as the same value (at least on the Model FX). The difference between the two values is equal to decimal 128, thus by taking the printer's control-code character's decimal value and adding 128 to each character's value, new decimal values are created to control the printer. The keyboard characters for those values can be looked up in the Model 100 manual in the ASCII character code tables on page 211. In this sense, you may be able to produce the needed 0 or 48 values (or rather usable substitutes) with respectively, GRPH p or GRPH 7.

Hugh Tining
75755,1540

FINDS ARTICLES SILLY AND LACKING INFORMATION

You're going to have to do better. Ninety percent of what I have seen in your new magazine is off-the-top-of-the-head first-person stuff with no information to impart. And it's not even pleasant reading.

Jim Hughes' silly piece on the Kaypro II hit the heights. We don't give a hoot about his New York brownstone, his Maine cabin, or his book. And is it supposed to be some sort of technical feat to hook a Kaypro to a Model 100? Pooh. Do we care to see the author sitting in his World Bazaar swing by the lake?

Editors, please spare us the drivel. We want information, not silly pieces on what I did with my Model 100. We could also live without big photos of nicad batteries and Tandy executives.

Your problem is that you've got some space but not much information. And you just can't go on being an easy sell for bad writers. Please get some information.

David Dalton
Tabacoville, NC

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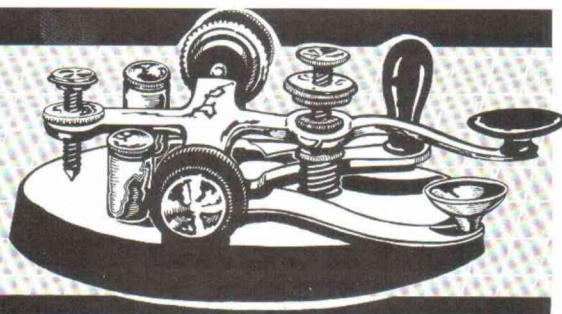
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THE WIRE



MICRO MARKET SHOOK UP BUT NOT SHOOK OUT

By JOHN P. MELLO JR.

The theme was battery-operated and portable computers, but the subject was shakeout at a seminar held in San Diego by Future Computing, a marketing and consulting firm headquartered in Richardson, TX.

It was apparent very early in the seminar the topic of shakeout —

banded freely in the business press since Osborne Computer Corporation's crash last fall — disturbed many industry representatives. So much so that, after Future Computing's analysts finished their introductory presentations, one marketing group's president and chief executive officer, Dr. Portia Isaacson, felt compelled to make an impromptu speech on the subject.

"We would agree," Isaacson said, "that at this time, our industry is shook up, but not shook out. Our industry is very healthy."

MORE FIRMS, MORE MONEY. "Next year there will be more companies making more money than they are making this year," she said, then warned, "But it won't be the same

mix of companies."

She said Osborne's fall showed the margin for error in the market had narrowed. "There are windows you have to hit now," she observed. "With portable and battery operated computers, sometimes I think it's three months."

But even the optimistic Isaacson admitted: "When you try to jump on a freight train, which our industry is, it's risky. The risk is much higher now than it was a year ago."

Ronald Ogg, former director of product marketing for Osborne, joined Isaacson in discrediting the shakeout predictions in the press: "Is this a signal of the industry shakeout? I don't think so. I think that whole thing is crazy. If Osborne hadn't had its fiscal control prob-

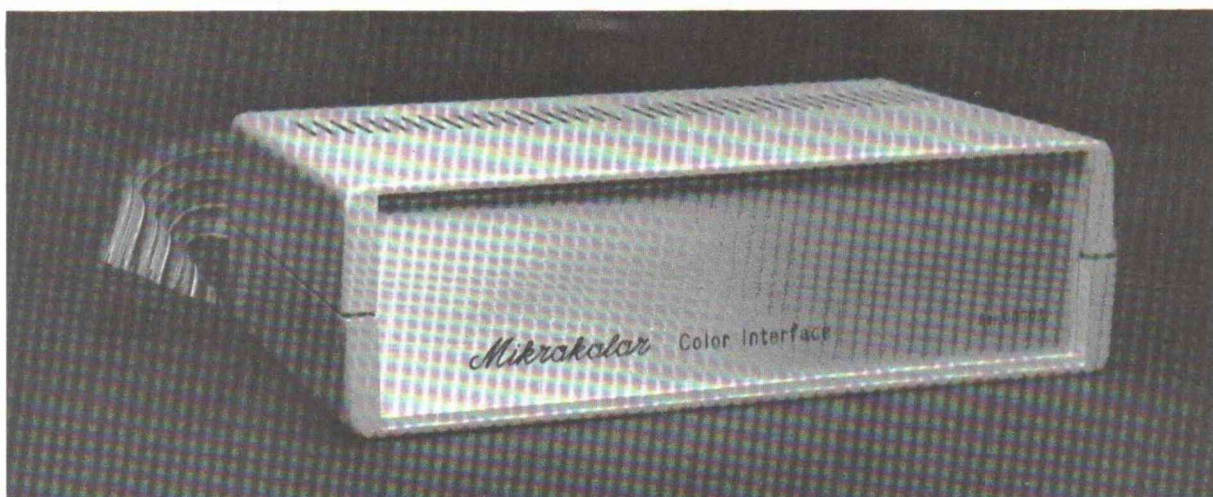


Portia Isaacson

Osborne's failure has shook up industry, but it isn't sign of a shakeout.

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4. Graphics 2 mode: Provides the same as Graphics 1 mode, except allows 16 colors per character.

Sprites are prioritized 3-D slide planes, 32 in all, capable of displaying 15 colors plus transparent. This allows easily programmed graphics animation capability for use with business displays, graphs, charts or games. Unit provides Composite Video output for use with any color television when employed with a modulator, or by direct connection to a color monitor. Use with a black & white television or monitor allows 16 gray levels to be used instead of colors. No hardware modification is necessary to your set, as the unit plugs into the existing buss expansion socket. The Texas Instruments TMS9918A Video Display Processor uses no memory from your set, it has it's own on board RAM. Other models supported are S-100, TRS-80 Models I, III, 4 and 12 and Apple II. For information on use with other models, send complete buss information and method of addressing with a large SASE to our technical department, P.O. Box 5686, Vandenberg, California 93437. Bare boards are also available for universal adaptation to almost any 8 bit system.

The Model 100 Mikrokolor will come complete with manual containing sample programs. Also available will be a text translation program that will provide full screen text capabilities of 24 lines of 40 characters a line, with full cursor and scroll functions. VHF Modulators are available also at \$54.00 including cable (powered by Mikrokolor unit). These operate on channels 7-10 VHF.

The Mikrokolor is available at the introductory price of \$235.00 for assembled and tested units, or \$195.00 for kit of all parts. Both come with full documentation. User Manual only \$5.00. Money order, COD, check or credit card. Personal checks must clear. COD add \$2.00. Visa, Mastercard add 4%. Cal. res. add 6% tax. Custom installations are priced individually, on a case-by-case basis. Introductory prices good until December 25, 1983. Reg. Prices \$335.00/\$295.00. Order from:

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See cover article to 80 Micro, May '83 for additional info.

*TRS-80 is a trademark of Tandy Corporation.

lems in 1982, the company would have survived. It had nothing to do with general market conditions."

GRAVY TRAIN. Those conditions, as far as Future Computing is concerned, look very rosy for portable and battery-operated computers. Its chairman, Dr. Egil Juliussen, predicted briefcase and book-sized units shipped in the United States would more than double from 1983 to 1984 and break a million in 1987.

He said 10,000 briefcase computers would be shipped in the United States in 1983. That would jump to 100,000 units in 1984 and reach 800,000 by 1988. On the book-sized side, shipments would reach 80,000 in 1983, triple to 240,000 by 1985, and reach 750,000 by 1988.

Juliussen saw briefcase computers outdistancing book-sized computers in retail sales through the 80s. He pegged retail sales of book-sized

units in 1983 at \$96 million. Sales would climb to 154 million in 1984 and reach \$638 million by 1988. Briefcase micro sales would be \$35 million in 1983, zoom to \$330 mil-

lion by 1984, crack a billion dollars in 1986, and two billion by 1988.

According to Gavilan Computer President Manny Fernandez, one reason the market will be panting



Future Computing Chairman Egil Juliussen

Big gains predicted for battery-operated and briefcase computers.

OSBORNE VICTIM OF SUCCESS, NOT SHAKEOUT

Success, not market conditions, soured Osborne Computer Corporation's business fortunes (*Portable 100*, November 1983, page 12).

That's the opinion of Ronald Ogg, former director of product marketing for Osborne. Ogg was a featured luncheon speaker at Future Computing's seminar on portable and battery operated computers (see "Micro Market Shook Up But Not Shook Out").

In 1981, Ogg explained, Osborne had a running rate of \$10 million a year; by 1982, it approached \$120 million; by the end of that year, an estimated \$250 million. "It is almost unheard of to have that kind of running rate imposed on a company in that short a period of time," he said.

The "family" style of management at Osborne was adequate while the firm was small, he maintained, but led to woe when the company's business exploded.

If somebody needed something, he said, "a person simply went out and bought it. There was no central signing authority required because of this idea that it was kind of a big family."

He explained, "Hiring, especially of temporaries, could be done by anyone who had a need. Unfortu-

nately, temporaries have a tendency to become long-term temporaries or pseudo permanent people on staff." By January 1983, Osborne had 1200 employees — approximately 400 of them temporaries. Ogg said approximately because "nobody really knew how many there were."

Part of Osborne's business approach was to hire consultants for design and development of its products. "There was almost an unlimited use of consultants," Ogg observed. "Pretty soon you'd have three \$100,000 contracts going at the same time on something someone should have said yes or no on, but that just happened."

Hiring consultants caused another problem, he said. "Relying on consultants for your critical software and hardware design efforts meant that every time something had to be modified, or you wanted to leverage a design into a different machine, you had to either get those consultants, who then had you dangling by a string and could charge you whatever they wanted, or you'd have to start over."

There were also a number of "mis-directed software contracts", Ogg said, like the firm's pact with Digital Research. "Osborne has a contract

with Digital Research for 10,000 copies of PL1. Digital Research probably won't sell 10,000 copies of PL1 to everybody in history."

To complicate matters, financial records at Osborne didn't reflect what was going on. "A bill would come in, accounting would get it, and of course they wouldn't have a copy of the purchase order," he said, "but the name of the person that requisitioned it would probably be on the invoice. If it was, they would send that bill to that person, where it would probably get filed and nothing would happen to it."

"Vendors didn't press Osborne as hard as one would expect because it was obviously a high-flying company and you don't want to damage your relationship with somebody who was booming like that."

Ogg concluded: "The bottom line on the management was: Who was in control? The answer was everybody. And as a result, that means no one was in control."

Was there any one person responsible for Osborne's downfall? No, said Ogg. "You can't pin the blame on any individual person. It was the circumstances of success, out of control success."

—John Mello

for portables in this decade is because computer manufacturers have scrapped a fallacy they've harbored for years.

FALLACY STIFLES GROWTH. Everyone was telling me, Fernandez said, the need for computing power away from your desk is very different than when you're at your desk, "so you can charge into the world with a calculator."

"This is as far from the truth as any statement you can make about computers," he noted. "This fallacy in the industry has prevented it as a whole from being able to exploit and satisfy the mobile professional."

"The reality is," he continued, "when you are away from your desk, the need for a computer that can be of true help — that can replace your desk, your file cabinets, your secretary — becomes even more critical."

OFFICE WITHOUT WALLS. Now that the industry has recognized the error of its ways, he maintained, revolutionary changes are in store for white-collar workers. "I think we have changed office automation forever," he said. "We have created officeless automation. The whole idea of a fixed desk with fixed walls is totally out the window."

A critical element in the growth of the portable market, he contended, is software. "The reason less than 1 percent or less of the mobile professionals market in the world has been penetrated is because software has not been available."

Isaacson added, "More than any other manufacturer [independent software developers] determine the fate of this industry."

Bill Walters, "buyer" for the Model 100, represented the Tandy Corporation at the forum. "Just as inevitable as death and taxes," he noted, "we will have larger displays, lighter weight, more power and more powerful computers within the next two years."

I say 'we' in the market sense, not specifically the 'we' of Radio Shack. You can be sure we're studying very carefully the next steps to take. I'm not about to stand here and tell you we're going to ride the Model 100 forever. It's recognized as a first generation product, but a first generation that will be around for some time to come yet."

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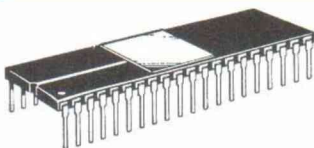
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TeleLearning
A "knowledge package" for seekers of higher education.

SILICON ENTREPRENEURS SET UP DIAL-UP UNIVERSITY

by Alan D. Abbey

If you want to enroll in the new "Electronic University," you will need a personal computer, not a high score on the Scholastic Aptitude Test or a parent who knows an admissions officer.

A group of Silicon Valley entrepreneurs has put together a national education network where students from across the country can take up to 170 courses just by tapping the right buttons on their home computer—and paying the fees.

Telelearning Systems, Inc. an-

nounced the program at a press conference held at the Capital Hilton Hotel in Washington, DC.

SECRETARY BELL. The telecommunication project won the blessing of U.S. Secretary of Education Terrell H. Bell: "The thrilling thing about this electronic university is its flexibility and its adaptability as far as its ability to reach all learners on all levels and then to teach them, where they are, and then to individualize the instruction for each and every student."

The Telelearning Systems "school" will work like this:

To get in, a person who owns any of a wide variety of home computers, including Radio Shack models, will buy a "knowledge package." The package will consist primarily of a course catalog and sophisticated software to link the home computer to the company's network of teachers.

After purchasing the package for \$100 to \$230, a computer owner will then sign up for the courses he or she wants. The cost of the courses will vary from \$35 to \$150 per les-

son-hour, depending on the subject and the notoriety of the professor.

The course fee will cover telephone charges and transmission costs, as well as the professor's electronic lectures. The students will receive the text and graphics used to illustrate the teacher's lesson on their home systems.

NOT TYPICAL MAIL COURSE. In addition to sending the prepared material by oomputer, the program steps out from the traditional correspondence course by allowing a student to communicate directly with his teacher through computer. A student will be able to type out questions during specific office hours during the week.

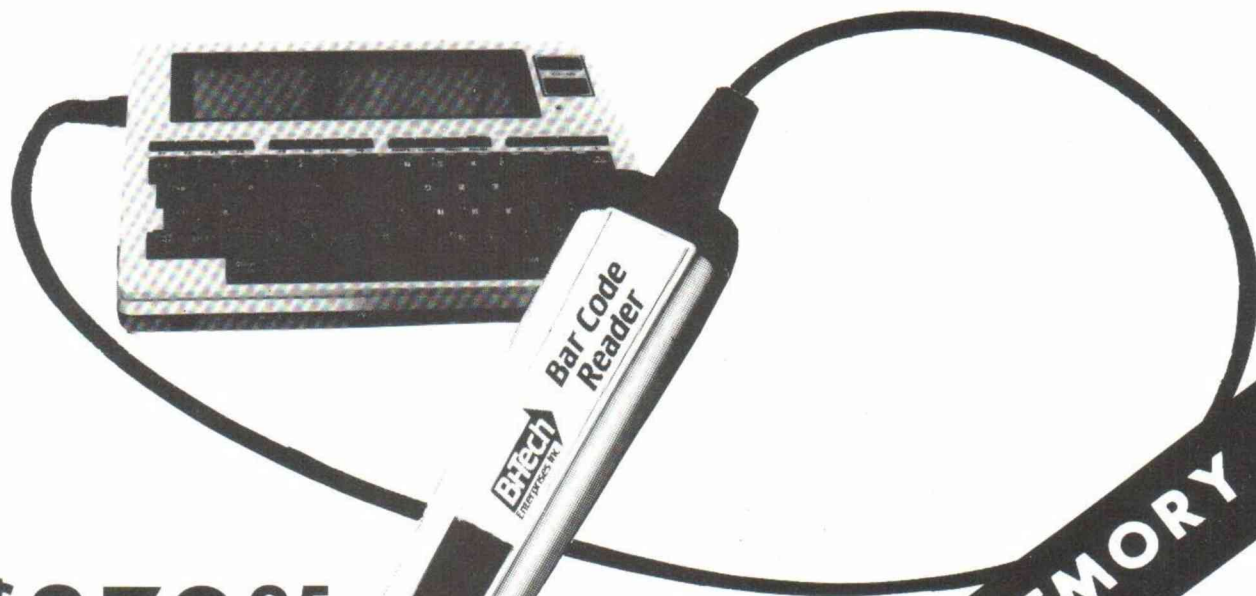
The professor will receive the query within seconds, and respond immediately, allowing direct contact. That is the system's key selling point and major difference between it and a correspondence course.

"The trouble is that when you are working on a course and you are interested, you want to get results of questions and tests now, not three weeks from now in the mail," said

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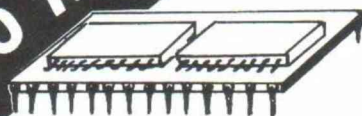
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Ron Gordon, chairman of Telelearning Systems.

Gordon's presence lends the operation credibility, because he was chief executive editor of Atari, Inc. from 1974 to 1977, and has had a hand in numerous technological advances of computers.

CRAPS TO JOYCE. Courses available now range from human sexuality and crap shooting to James Joyce and contemporary American poetry. The company promises 500 courses and 800 teachers by next year.

One series of courses on business management is being offered by the American Management Association. If you want to learn how to write a business plan or plan your cash flow, you can now do so at your desk or at home, depending on where your computer is.

So far, none of the courses carry college credit. But the catalog includes courses that will prepare students to take degree-equivalency exams in many states and university systems.

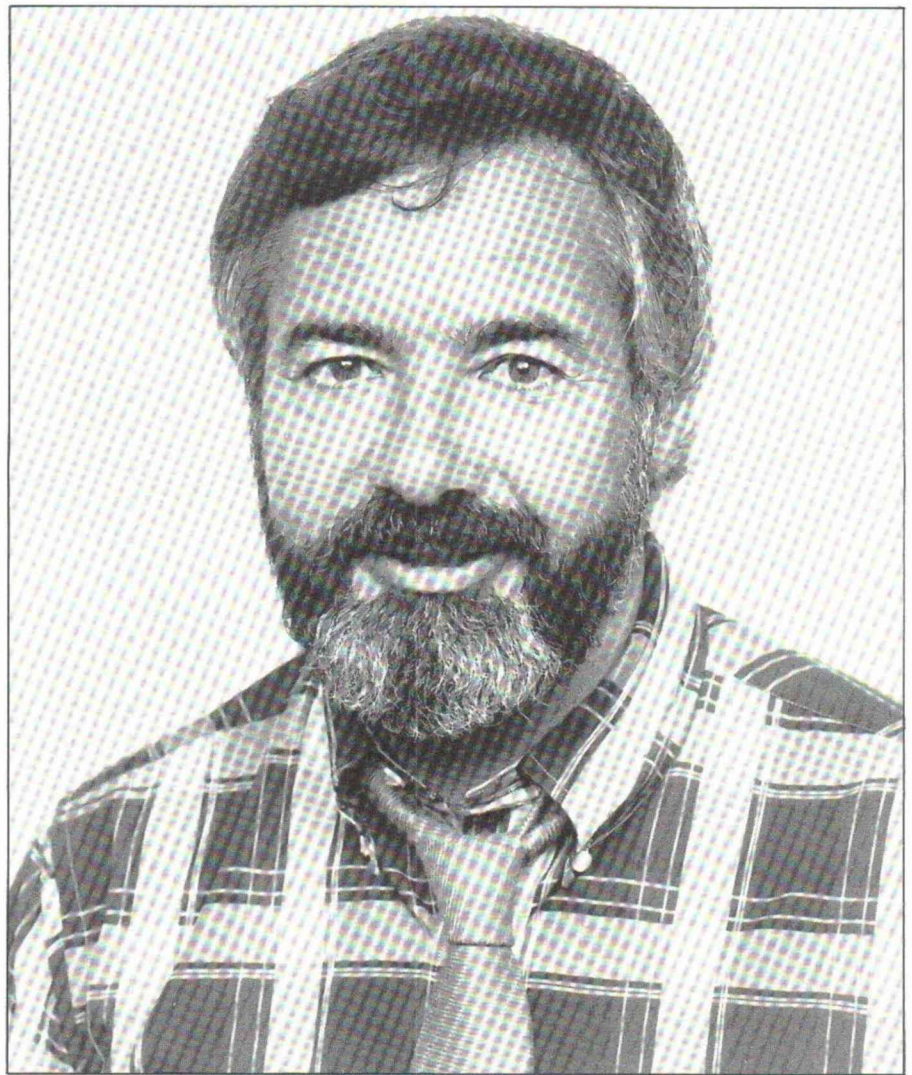
Telelearning is negotiating with a number of colleges to get credit granted for the courses offered by the company. Colleges themselves may begin offering courses over the computer network.

TELECOM BREAKTHROUGH. Technologically, the system is a breakthrough because of the elimination of protocols needed to get two computers talking to each other, the company said.

The only steps students will have to take in order to communicate with their instructors is to push one button on their computer keyboards. Users will not have to wait for codes, log-in sequences, or back-and-forth terminal identifiers. Communications will be automatic, and, the company predicted, less expensive, less error-plagued, and faster.

It will allow, among other things, automatic dialing without smart modems, automated file transfers in both directions, message storage and transfer of digitized photographs and graphics.

To reduce the possibility of errors, the system will also feature an error detection and correction protocol between the personal computer and the TeleLearning machines.



TeleLearning Chairman Ron Gordon

Students want results now, not three weeks from now.

MONITORS EVERY PULSE. The system has an analysis feature built in that is designed to monitor every function and response on the phone line, the network, the host, and the receiving computer. If it hears the wrong signal at any point — and it is supposed to know what to listen for — it will make its own decisions about how to correct the problems or choose another communications route. It will use Tymnet, Telenet, and Uninet switching networks, and be capable of switching among the three automatically if problems arise.

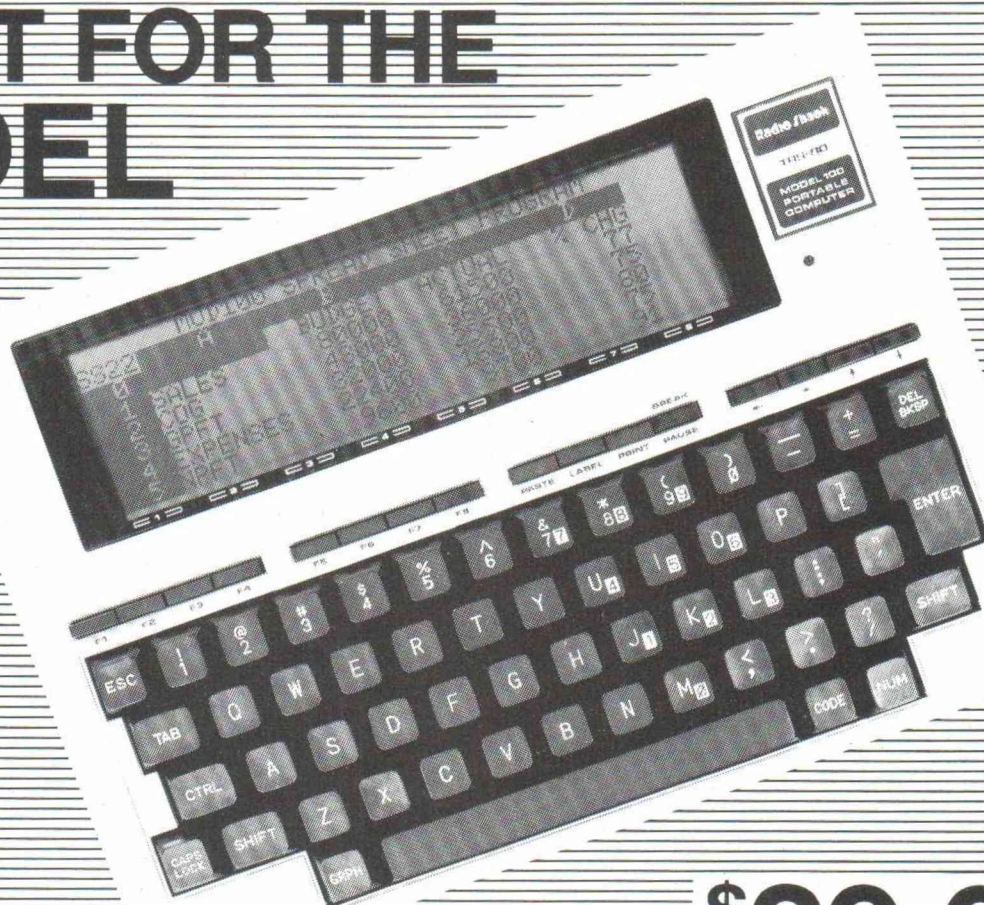
The company has lined up an impressive list of people to speak about the system's promise. Among them is James K. Coyne, a former congressman from Pennsylvania. Coyne, a computer whiz while on Capitol Hill, is now President

Reagan's special assistant on private sector initiatives. "Never before has technology offered such promise to broaden the ability of society to provide effective, low-cost instruction," Coyne said.

Donald J. Senese, the Education Department's assistant secretary of educational research, said the electronic university will be "an effective tool for providing training and education to those who otherwise may not be able to benefit because of constraints of time, resources or access."

If the program attracts students and expands, we soon may see thousands of people studying at home, making contact with teachers they have never seen. The one tradition that may shatter, though, is bringing an apple to the teacher [For a related column, see *End of Transmission* on page 64].

AT LAST! AN INEXPENSIVE SPREAD SHEET FOR THE MODEL 100



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If you are tired of using a pencil and paper next to your Model 100 just to do the simplest of calculations, then Datamasters has the answer.

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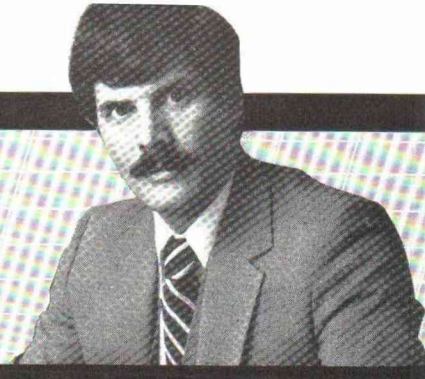
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What other types of software would you like to see made available for the Model 100?

TELECOMPUTING



BEAT THE CHRISTMAS CROWDS BY LETTING YOUR MICRO DO YOUR SHOPPING

Want to avoid the Christmas crowds? Try electronic shopping.

One of the more highly touted advantages of videotex is its electronic shop-at-home convenience. Shop at home is not new. I merely have to count the numerous catalogs that my wife and I receive to know that catalog ordering is big business. But you can also shop-at-home using your computer.

There are several shop-at-home services on CompuServe, Dow Jones and The Source that will display an electronic catalog and process your order with only one phone call.

TEN OFFERINGS. On CompuServe for example, there are currently over 10 separate shop-at-home services offered. Most of these services are menu driven and very easy to use. They can be found at HOM-40 or PCS-40. They include:

- Howard Sams, offering technical, computer and other books for sale;
- The Athlete's Outfitter, offering

sporting goods and clothing;

- The Music Information Service, specializing in printed music, musical instruments, and accessories. Their most popular offerings are records and tapes;

- Primetime Radio Classics, with over 1,000 cassette recordings of those old time radio classics of the 30s, 40s and 50s;

- AutoNet, allowing you to compare car features from over 250 current models prior to making a purchase; and

- Fifth Avenue Shopper, available for the more discerning tastes. It offers books, flowers, perfumes and even Godiva chocolates. And it will ship flowers to most locations in the world.

LARGEST SERVICE. Comp-U-Store is the largest shop-at-home service and offers over 50,000 items — appliances, cameras, flatware, luggage, sporting goods, stereo equipment, TVs, video equipment, watches, computer products — and more

than 200 brands — Canon, GE, Litton, Nikon, Panasonic, Pioneer, Sony, and Zenith.

Membership fees are \$25 for one year or \$40 for two years. With your annual membership fee, you receive a membership kit with a membership number, user's manual, and a free VISA application. You do not need a credit card to place an order. Compu-U-Store accepts checks (prior to shipment). You are still responsible for the connect time charges for the videotex service.

DISCOUNTS. Comp-U-Store offers its items at 10 to 40 percent off manufacturers' suggested list price and the quoted price includes shipping to your destination. Prices in the data base are updated daily and the products carry a full manufacturers' warranty.

When you enter Comp-U-Store, you will see figure 1.

- (1) HELP & Information
- (2) Shopping & Ordering
- (3) To process a stored order
- (4) Databasement (Bargains)
- (5) Comp-U-Stakes (Auction)

Figure 1.

Comp-U-Store uses a different set of commands than CompuServe or the other information services.



TOP at most prompts will return you to the first menu. An END at the TOP menu will exit you from the data base.

The most frequently used commands are REV for reviewing (redisplaying) the same page; Pn to display page n; LIS to list product categories; and HEL for additional help.

DIFFICULT ACRONYMS. The product categories I found to be difficult to remember. They are four letter acronyms. For example, TV video cassette recorders are TVCR; the code for TV sets is TVSN.

In addition, you may have to list the brand codes, also four-letter acronyms. For example, Panasonic is PANA, Sony is SONY, and Kenwood stereo is KNWD. I found, however, selecting NP, for no preference, easily provided a list of brands that met my spending limit.

HOME BANKING. In addition to home shopping, you may also use your computer for home banking. While most videotex services are still experimenting with home banking, CIS actually has four "real" banks on line: First Tennessee Bank in Knoxville, TN; the Huntington National Bank in Columbus, OH; Shawmut Bank of Boston; and the Central Trade Bank in Memphis, TN.

The banks provide bill paying, checking, and savings account statements, and other services. You can live in New York and still have your primary bank in Tennessee and actually have your paycheck deposited automatically with that bank. They may be instructed to transfer funds to your local bank account for necessary cash as well.

The age of home shopping and home banking is just dawning. But before this concept is really accepted, there must be a uniform set of commands used by all major videotex information services before it will be universally accepted.

In the meantime, before you start dropping hints for that extra 16K RAM or a Model 100 printer, take a look at what compushopping has to offer. 🐦

Bill Loudon is the product manager for personal computer services for the CompuServe Information Service. He sponsors the Model 100 SIG on CIS.

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TANDY TALK



NIX BOTHERSOME CARRIAGE RETURNS AND USE COMM TO TALK TO YOUR MOD4

This month I'd like to talk about uploading and downloading on the Model 100.

Having been around since the beginning I find I tend to take a number of things for granted. I have to catch myself when I hear about things others are just discovering for the first time and not react, "Why, of course it does that!"

For example, take a review I read recently that went to great lengths to describe how TELCOM had been used to upload files into Wordstar on a CP/M system. The only complaint was all the imbedded carriage-return characters had to be removed. Then the article described in great detail how to do that. Gee, that's the hard way!

When you use TEXT, you don't have to press enter at the end of each line thanks to "word-wrap". If a word is longer than what will fit on the remainder of the display, it automatically "wraps" to the next line and leaves blanks at the end of the previous line.

WORD WRAP. To have this capability really makes sense. We included a similar word-wrap for printed output when shift-print is pressed in TEXT. This way, you can select the line length you want (from 10 to 132 characters) without worrying about words being split at the end of any line. This same core of code is used in TELCOM when you transmit a file from the Model 100 to another system using upload. However, in evaluation, I found it was a real pain

in the neck to have a fixed line length. And it made text files transferred to Scribes on a Model II almost impossible to use *because of the carriage returns at the end of each line.*

The solution? Simple. When uploading with TELCOM, respond to the Width? prompt with an enter. That indicates the file is to be transmitted *exactly* as it was created. That is, without *any* carriage returns, except the ones you put in the file when you wrote it. It works great!

While I'm on the subject of uploading, some readers have asked me, "Why didn't you include a sample upload-download to a Model III and 4 in the 100's manual?" Basically, because the Model 4's software wasn't firmed up when the Model 100 owner's manual was written. And the Model III isn't sold with a terminal package.

MOD4 TERM. However, since the Model 4 *does* have a fairly nice terminal package, let's see what's required to hook the two together.

The hardware you'll need is listed in figure 1. The first three items are self-explanatory. But what's a null modem connector? It's a small box with two RS-232 connectors wired in a special way. It reverses several signals and permits two computers capable of communicating through a modem to communicate without one. [Editor's Note: For an explanation of how to build a null modem see *Portable 100*, September 1983, page 38.]

TRS-80 Model 100
TRS-80 Model 4 disk unit with RS-232
RS-232 cable
Null Modem connector

Figure 1.

Now let me run through the Model 4 communications procedures by the numbers. First, boot up your system and answer the date question. Then type in:

```
SET *CL TO COM/DVR <ENTER>
SETCOM (BAUD=9600) <ENTER>
COMM%b9Q UI
```

You will see the prompts indicating the COMM program has been executed. Now enter the following sequences (explanations are after each):

```
<CLEAR><I>
<CLEAR><:>
```

This sets duplex to half on the Model 4. Typing on the Model 4 keyboard will appear on the Model 4's monitor and the Model 100's LCD.

```
<CLEAR><">
<CLEAR><:>
```

This turns echo on. Since the Model 100 is in full duplex, it expects its "host" to send back characters received. Now Model 100 keyboard characters will show on the Model 4 and Model 100.

<CLEAR><#>
<CLEAR><:;>

This turns echo linefeed on. When Model 4 receives a carriage return, it will send back a carriage-return/line-feed sequence.

<CLEAR><*>
<CLEAR><:;>

This turns the X-ON/X-OFF handshake on

You can now verify that the Model 100 communicates with the Model 4 by selecting TELCOM and setting the status to:

87E1E <ENTER>

then selecting TERM <F4>

You will be "on line" with your Model 4 and communicating. Everything typed on the Model 4 keyboard will display on the LCD of the Model 100 and everything typed on the Model 100 will be displayed on the Model 4's screen. The only drawback is when enter is pressed on the Model 100, the Model 100 LCD will show a line "skipped," that is, effectively, double spacing. This should not bother you in the normal upload/download sequence.

Now, to accept a file from the Model 100 and save it onto a Model 4 disk, do the following on the Model 4:

<CLEAR><6>
<CLEAR><9>

and respond with the name you want your file to be saved as on disk.

<CLEAR><7>
<CLEAR><->

Turns the automatic "dump to disk" off required by the Model 4, since we're communicating at speeds higher than 300 baud.

<CLEAR><6>
<CLEAR><:;>

Turns on the file receive buffer in the COMM program.

Now on Model 100, select upload (F3) and respond with the desired file name to send to the Model 4. If you don't want fixed line lengths (imbedded carriage returns), answer the width prompt by just pressing enter.

When upload is complete, enter the following:

<CLEAR><6>
<CLEAR><->

This signals the Model 4 to stop receiving data from RS-232 into buffer area in COMM.

<CLEAR><7>
<CLEAR><:;>

This will save your buffer to disk.

<CLEAR><6>
<CLEAR><0>

Closes your disk file. If you forget to perform this step, everything up

to this point is wasted; you'll get an 0K file on your Model 4! This is experience talking!

The reverse operation is much simpler! Simply set your Model 100 up in TELCOM and in terminal mode, select down and answer with the name you want your file stored under. Then on your Model 4 do the following: (This assumes communications are already established)

<CLEAR><5>
<CLEAR><9>

Answer with the name of the file to be sent from the Model 4 to the Model 100.

<CLEAR><5>
<CLEAR><:;>

This says "send the file."

When the transmission to the Model 100 is complete, enter the following to finish up on the Model 4:

<CLEAR><5>
<CLEAR><->

This tells the Model 4 "turn off file transmit function."

<CLEAR><5>
<CLEAR><0>

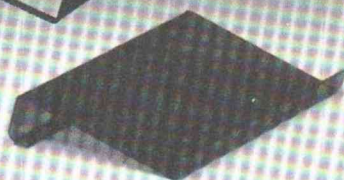
Resets file transmit operation, effectively concluding operation.

On your Model 100, press down <F2> to close your newly received file in memory.

Operating the Model 4 COMM package for file transfer operations to the Model 100 really isn't complicated but does take a little bit of practice. Give it a try, I think you'll like it! ♣

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PORTABLE COMMANDER



AS MODEL 100 CONVERTS INCREASE EACH DAY, COMPUCHURCH GETS NEARER

It's amazing what creative thoughts occur when people are confronted by a new phenomenon. The more unique the phenomenon, the more unique the ideas. I guess you're placed in a situation where you have no choice but to brainstorm. Of course, the Model 100 is such a new aid to creativity it's hardly surprising to hear of some of the enterprising ways it's being used. Or being proposed to be used...

Based on this notion of creativity, you'd be unlikely to guess what the source of my inspiration was for this month's column. Divine, you might say. Let's just say it's probably a good thing that the editor of this magazine — John Mello — isn't a minister of the church. He and I were talking about the Model 100 and how it's spawning a host of ingenious uses. The night before, as sysops of the Model 100 special interest group on CompuServe, we'd been showered with programs to play tunes on the machine. They're still in the SIG data base right now if you fancy a croon after a hard day's programming. He wondered how long it would be before we received our first hymn.

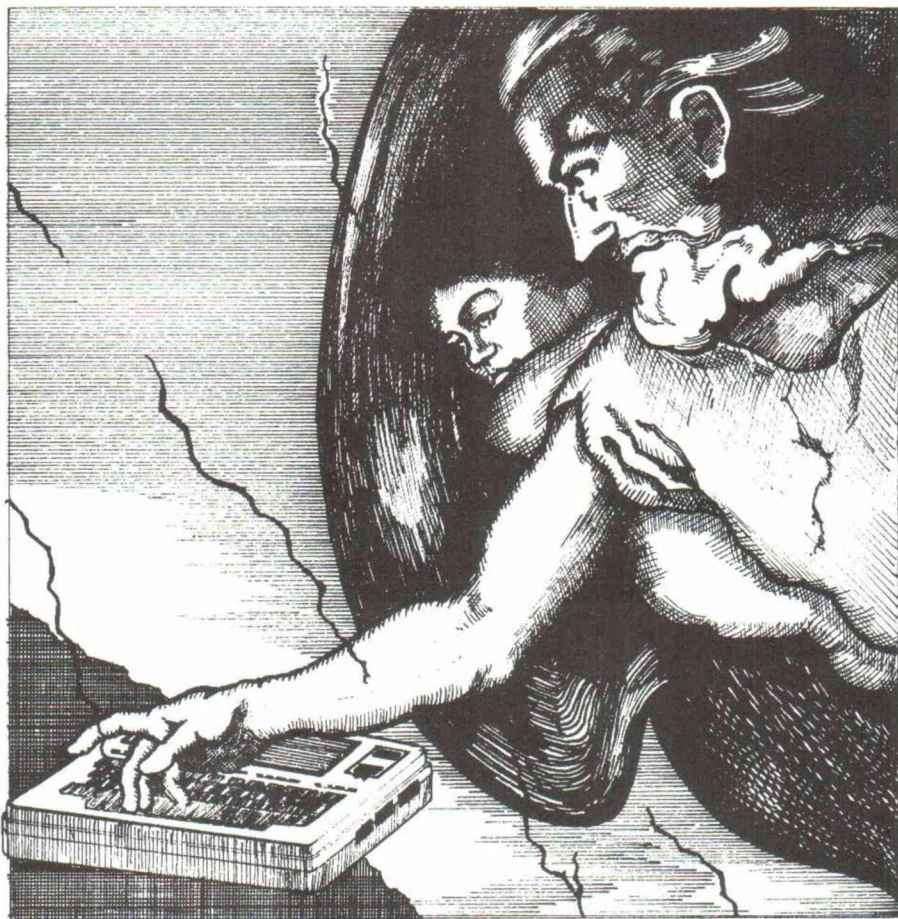
That was it. The creative juices started flowing (with some flippancy, I might add.) Naturally, there was no reason to stop at mere hymns. The sky was the limit, you might say. With CompuServe and holy tunes in our minds, the giant leap was easy — CompuChurch. That would be next. It was so obvious. It would be the logical step to promote a more progressive Christianity.

DIGITAL BIBLE. Come Sunday morning, we traipse off to a new kind of hacker's heaven. Under our arm we carry a digital bible — the Model 100. Today's preacher may not be there to greet us on our arrival. He's frantically putting the final touches on his sermon, cutting and pasting the conscience-pricking pieces for best effect.

The last couple of month's donations seem to have bought a new

Model 100 now hanging on an outside wall, scrolling the subject of the sermon and today's hymn numbers, followed by the amount needed to rebuild the steeple.

Once inside, just pick a comfortable pew and reflect for a moment where the 20th century has brought us. Then time to plug in. What's that shiny thing above the hassock? Yea verily, it's a socket for the RS232, of course. And I hope you didn't forget your cable and have to borrow one like last week. Plug in, log on, and if you're a regular member, give your password number.



Now things can really get going. The congregation has downloaded those hymn numbers followed by the very tunes and words themselves. The minister, ready for better or worse, plugs his machine into the master pulpit socket. Into Basic he goes and loads the latest version of SUNDAY.BA. This sends the signal everybody's 100 is waiting for and the first hymn is loaded from RAM. A quick note to give everybody the key, and we hear the cute sound of lots of Model 100s accompanied by owners, eyes screwed up, following the words on the display. Just like always, Ms. Jones' machine is singing half a semitone sharp and Mr. Evan's machine has been tweaked to be louder than anybody else's. Old Ma Smith's already asleep in the corner — her machine always in a POWER OFF condition. Some of the clever attendees — the ones who leave their tunes on the Model 100 SIG — will have special software modules. Their machines sing descants and little twiddy bits between verses. What a delightfully, technologically holy sound!

EPSON MISCREANT. After that bracing start, it's time for a sermon, and don't think you're getting this downloaded at 19,200 baud for perusal later. Set those machines to 75 baud, darn you and see how long you can stay awake.

And goodness gracious, isn't that you he's talking about? He's been on CompuServe again and caught you saying those wretched things to that miscreant who bought an Epson HX-20. Nobody catches you blushing though. They all think he's talking about *them*.

When it comes to collection time, there's no passing the tray with a prestigious shake and a net outlay of zero. This guy uploads fiscal statements to all and sundry. And remember that password? That was your credit card number and I hope your account is in order. That steeple's got a long way to go yet.

So much for a simple Protestant service. Life can be a little more complicated if you're a Catholic. You must take into account confession. Once again, a socket awaits, placed discretely inside the confessional. Hit the paste button: "Bless me father, for I have sinned." That was easy.

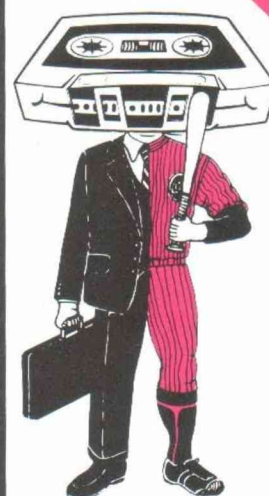
Now to upload all that stuff you shouldn't've done but did yet again. This calls for sophisticated software from the priest. He'll be on the lookout for certain key words and assigning an SQ (sin quotient) to each of them. "Two thousand four hundred fifty-three Hail Marys at 110 baud" won't be an uncommon penance. Saunter up to the altar looking like it was only 500 and edit the for-next loop down from last week's value. Plug in at the altar and wait while the print statements are counted off and checked against your confessional entry file. That'll teach you to admit to *that* again.

WEDDINGS, FUNERALS. Let's face it, it could go on and on. What about weddings, funerals — even christenings. Imagine the family group huddled round the font while a Model 100 picks a splendid name for your seventh son. A quick dunk of the kid followed by baptize this child..." (short pause) FOR X = 1 TO RND(1)* 100: BEEP "...Septimus Norbert." Stifled sniggers from that ratbag of a brother-in-law, who as chance would have it, was only playing with your Model 100 last night. He seems to have added a few names of his own to the "boys names" data base. Just wait till it's his turn — you can slip in some airplane and car graphics into his kid's name. Watch him sign a check with that!

And who says Christianity has to bear the full thrust of this hi-tech religious onslaught? CompuTemple would be a sure thing. The CompuKoran would download a new section every day. Model 100s could be fitted with a compass to guarantee no religious utterances unless facing in an easterly direction (plus or minus .5 radiant)

Well, I hope these meanderings haven't offended anyone. My telephone line was struck by lightning a couple of months ago. It frazzled a couple of chips in my direct-connect modem. Now I figure me and the Big Beeper are all square. If He's listening, I pray He runs this:

```
10 FOR X = 1 TO 4
20 READ CH
30 PRINT CHR$(CH);
40 NEXT X
50 DATA 6,77,69,78
```



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Frogs to clowns, you can create them
all with a little help from Sketch Pad.



Sketch Pad allows you to quickly create an illustration and record it in a second program which writes itself from instructions in the first program.

It's like telling one robot to build another — to your exact specifications.

I've used the program to add graphics to a logic-adventure program I wrote, to create a Model 100-based Cyrillic alphabet for a friend studying Ukrainian, and to illustrate a program showing constellations. I have transferred graphs, logos, and other small art into computer graphics by laying a transparent template of the art on the screen and tapping in the same shape below.

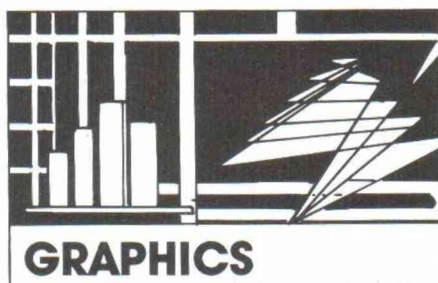
SILHOUETTES. Best of all and least frivolous, my children and I have simply played with the program, and from this play developed more ideas. We have overlaid silhouettes with graph paper and digitized the image into the machine, then used a short program to print versions of the drawing.

The main program requires 32K of memory to create the recordings of illustrations, but the created programs run in fewer bytes than that. The memory required depends on the complexity of the drawing.

To avoid a program crash due to memory lack, the only program or file in the computer should be Sketch Pad itself.

EYEBALL-BENDER. Program Listing 1, Sketch Pad, is the main program. Listing 2, Examp, is an example of the program created by Sketch Pad. Listing 3, Clown, is a longer example of the created program, I won't fault anyone who avoids the eyeball-bending work of keying in Clown, though you miss seeing a cartoon clown's face. I include the listing only to point out that it was self-created in less than five minutes, including the initial drawing.

Sketch Pad's basis is the same as Etch-A-Sketch, the copyrighted educational toy marketed by Ohio Art Company. Listing 4, Draw, is a short program that will easily fit into an 8K system. Children may enjoy



using Draw in the same way they play with Etch-A-Sketch, with an added erasure feature. The player may range over the entire screen, and instructions for play are the same as given ahead for drawing in the program Sketch Pad.

Now let's key in the main program, Sketch Pad. Even if you are used to typing Basic programs, you may discover some apparent strangeness, as in line 500, where perfectly good Basic commands are assembled within a string. This line and others like it are correct. They are created and passed on to a text (.DO) file which ultimately becomes the program which stores your art. I'll cover that later.

SAVING SKETCH. Important: Do the following exactly to avoid losing the program Sketch Pad from your system. Type line 100 and tap enter. Then type SAVE "SKETCH" and tap enter. Then continue keying in the program. If you have not saved Sketch Pad, the creation of the second program could erase Sketch Pad from the system.

When you run the program, you are first confronted by a prompt: ENTER FILE NAME FOR YOUR CREATION? Answer the prompt with the title of your yet-to-be-drawn composition. It must be six characters or fewer, because it will become the name of a text file. A warning here: As you debug the program during the keying in and answer this prompt with various nonsense names, you will be creating text files that are probably empty. Now and then, go to the menu mode, identify, and kill these meaningless files. Or else, use the same test name for the file so there is never more than one.

When you have named a file that will be used when running the program, the display blacks for several seconds. Then a box is drawn at the left of the screen and a single pixel

appears near its middle. This frame contains 2,304 points which can be turned on as part of the drawing. This is your canvas. Even with 32K of memory, a larger area is impractical.

MOVING THE PIXEL. Four keys move the pixel. The A takes it north, the Z south, the < west and the > east. If you depress the shift key as you tap one of the movement keys, the pixel will travel without printing, and it is in this way that you can also erase pixels.

As you begin creating the picture, you will notice a number to the right of the frame. It increases by one for each pixel added and decreases by one when you erase a pixel. You may continue your art until this number reaches 1,500. Then every pixel you create will be accompanied by the word limit and five beeps. This is a signal you are approaching the memory limit of the computer. You may erase to bring the number below 1,500. If you persist in adding more pixels, the program could crash. If you do and it does, don't write.

When your masterwork suits you, all you have to do is tap the P on your keyboard. With that single wiggle of a finger, the new program's creation begins. How long it takes depends on how many pixels you used in your picture. You will get a clue of progress by watching the area just to the right of the frame. A descending line of pixels will appear. A few seconds after the line reaches the bottom of the frame, the text file holding the code for the new program exists. You will know it exists because the program Sketch Pad ends with the announcement: SEE (FILE NAME).DO FOR ART PROGRAM.

Respond to the announcement by typing: RUN "FILE NAME". I'll clarify. If you called your art program FROG, then type RUN "FROG" and tap enter. This command creates a Basic listing of the text file and runs it.

CHANGE CLEAR. When you run it, you will see the art you have just created. This second program kills the text file version of itself the first time you run it. You cannot run it again without a slight modification. It errs the second time because there is no text file of the same name to

kill. So do this. Run the new program once. Then type LIST 110-115. For now you might refer to listing 3, EXAMP. for these lines. Follow the directions in the Remark line 115. It tells you to delete the characters KILL "FILENAME": and CLEAR from 15,000 to 100. If you get an OS — out of string — error, increase the CLEAR 100 to CLEAR

200 and so on until you have cleared just enough string space to run the program.

These gentle changes turn your created program into something which works every time. When you're satisfied it won't crash, type SAVE "FILENAME" (or SAVE "FROG" if that's its name) and the new program will become part of the

menu. It is a valid Basic program, which can be run and stored on tape.

Given some cleverness and attention to the Model 100 manual, you will be able to create several drawings in different files, append them and display more than one picture in a program.

HOW IT WORKS. Here's how Sketch

Program Listing 1. Sketch Pad.

```

100 REM * Sketch Pad
    TRS-80 Model 100 32K / Richard Ramella*
110 CLS
120 MAXFILES=1
130 CLEAR 1000
140 DIM A(49,49)
150 DEFSTR C
160 INPUT "Enter file name for your creation";FS
170 IF LEN(FS)>6 THEN CLS
    :PRINT "Too long. Try again, please."
    :FOR T=1 TO 50
    :SOUND RND(1)*5000+5000,1
    :NEXT
    :PRINT
    :GOTO 160 ELSE CLS
180 OPEN FS FOR OUTPUT AS 1
190 A=25
200 B=25
210 P=1
220 LINE(0,0)-(50,50),1,B
230 PSET(A,B)
    :V=V+1
240 A(A,B)=1
250 C=INKEY$
260 IF C="p" OR C="P" THEN 390
270 IF C=" " THEN 250
280 F=A
290 G=B
300 IF C="A" AND B>1 OR C="a" AND B<1 THEN B=B-1
310 IF C="Z" AND B<49 OR C="z" AND B<49
    THEN B=B+1
320 IF C="<" AND A>1 OR C="," AND A>1
    THEN A=A-1
330 IF C=">" AND A<49 OR C="." AND A<49
    THEN A=A+1
340 H=ASC(C)
    :IF H=60 OR H=62 OR H=65 OR H=90 THEN PRE-
    SET(F,G)
    :A(F,G)=0
    :V=V-1
350 IF A(A,B)<>1 THEN V=V+1
360 PSET(A,B)
    :IF V>1500 THEN PRINT @ 50,"Limit";
    :FOR T=1 TO 5
    :BEEP
    :NEXT
    :PRINT @ 50,SPACES(5);
370 A(A,B)=1
    :PRINT @ 50,V;
380 GOTO 250

390 F=200
400 FOR B=1 TO 49
410 FOR A=1 TO 49
420 IF A(A,B)=1 THEN GOSUB 690
430 IF LEN(G$)>230 THEN GOSUB 580
440 NEXT A
450 PSET(A+5,B)
460 NEXT B
470 GOSUB 580
480 G$="100 REM * "+FS+" TRS-80 Model 100"
490 PRINT #1,G$
500 G$="110 KILL "+CHR$(34)+FS+"
    ".DO"+CHR$(34)+"
    :CLEAR 15000
    :DEFSTR C
    :P="+STR$(P-1)+"
    :DIM C(P)
510 PRINT #1,G$
520 G$="1000 CLS
    :FOR R=1 TO P
    :FOR A=1 TO LEN(C(R))-3 STEP 4
    :G=VAL(MID$(C(R),A,2))
    :H=VAL(MID$(C(R),A+2,2))
    :PSET(G,H)
    :NEXT A,R
530 PRINT #1,G$
540 G$="1010 GOTO 1010"
550 PRINT #1,G$
560 PRINT @ 10,"See 'FS'.DO for art program."
570 END
580 IF LEN(G$)<4 THEN RETURN
590 G$=STR$(F)+" C(" +STR$(P)+")="+
    CHR$(34)+G$+CHR$(34)
600 FOR Z=1 TO LEN(G$)
610 IF MID$(G$,Z,1)=CHR$(32)
    THEN G$=LEFT$(G$,Z-1)+RIGHT$(G$,LEN(G$)-Z)
620 NEXT
630 PRINT #1,G$
640 P=P+1
650 G$=""
660 F=F+10
670 RETURN
680 END
690 Q$=STR$(A)
700 R$=STR$(B)
710 IF VAL(Q$)<10 THEN Q$="0"+Q$
720 IF VAL(R$)<10 THEN R$="0"+R$
730 G$=G$+Q$+R$
740 RETURN
750 END

```


Program Listing 2. Example.

```
100 REM* EXAMP TRS-80 Model 100

110 KILL "EXAMP.DO"
: CLEAR 15000
: DEFSTR C
: P=1
: DIM C(P)
115 REM * Make line above read
: 110 CLEAR 100
: DEFSTR C
: P=1
: DIM C(P)
200 C(1)= "22192319241925192220252022
21252119222022212222225222622272228
221923282319242824192520252125222525
252625272528252226252622272527222823
2824282528"
1000 CLS
: FOR R=1 TO P
: FOR A=1 TO LEN(C(R))-3 STEP 4
: G=VAL(MID$(C(R),A,2))
: H=VAL(MID$(C(R),A+2,2))
: PSET(G,H)
: NEXT A,R
1010 GOTO 1010
```



Pad works:

Line 140 dimensions variable A to 49 positions across and, as it turns out, 49 positions deep. These are pigeonholes for the 2,304 values of X,Y coordinates. It takes up a lot of memory to dimension anything this deeply.

Line 180 opens the text file you've named in line 160. It waits to receive material until your art is complete.

Creation comes in a loop between lines 250 and 380. Lines 300-330 change the position of coordinates A (across) and B (down), depending on the direction of your move. The key to storage is any pixel left on gives the array variable A(A,B) a value of 1; otherwise it's zero. Also in these lines, the program keeps count of the number of pixels that are on. If the un-magic number of 1,500 is reached, line 360 not only turns on the pixel but sounds and flashes a warning to tie things up and go on to creating the recording program.

When you're ready to record, tap the letter P, and line 260 sends the action upstream to line 390, where the new process begins.

LOOP LOOKS AT VALUES. In the two loops between 400 and 460, the program looks at the values of A(A,B) — all the points in the grid. If it finds a pixel is on by virtue of A(A,B) having a value of 1, it goes to a subroutine at 690. In lines 690-740, the number values of A and B are turned into string statements and added onto a building string represented by G\$ before the pro-

Program Listing 3. Clown.

```
100 REM * clown TRS-80 Model 100
110 CLEAR 100
: DEFSTR C
: P=14
: DIM C(P)
200 C(1)= "030206023702410245020203040306033803
4103440302040604390441044304020506054005410542
0502060606090610061306170619062106370638063906
4006410642064306440645060207"
210 C(2)= "060708071107130717071907200722074007
4107420702080608080811081308150817081908220839
0841084308020904090609080911091309150917091909
2209380941094409031006100910"
220 C(3)= "101014101610191022103710411045101812
1912201221122212231224122512261227122812291230
1218132413301305140614071408140914101411141214
1314141415141614171418142414"
230 C(4)= "301431143214331434143514361437143814
3914401441144214431405150615071508150915101511
1512151315141515151615171518152415301531153215
3315341535153615371538153915"
240 C(5)= "401541154215431506160716081609161016
1116121613161416151616161716181619162016211622
1623162416251626162716281629163016311632163316
3416351636163716381639164016"
250 C(6)= "411642160717081709171017111712171317
14171517161717181730173117321733173417351736
1737173817391740174117081809181018111812181318
1418151816181718191820182118"
260 C(7)= "221826182718281829183118321833183418
3518361837183818391840180919101911191219131914
1915191619191929193219331934193519361937193819
3919102011201220132014201520"
```


gram returns to the 400-460-checking for-next loop. In the loop, if the length of G\$ is more than 230 characters, it goes to another subroutine, this one from line 580-670.

A lot happens here. A tidy string is assembled to become a line in the new program. Line 590 creates the line number -F-, sets the name of the new string value - C(1) and upward - throws in needed quotes and puts the string material of G\$ between them. Lines 600-620 are a loop which removes all spaces from the string. Line 630 sends the G\$ value to the file you have created. For an example of the result, look at line 200 in listing 2. The numbers between the quotes are the values of the PSET(X,Y) coordinates of the art you have drawn.

When all the points of the art's frame have been checked, given values, turned into strings, and sent to the new program, the program Sketch Pad ends by creating the other lines required for the new program. This happens in lines 480-570. Notice, in a line 100 remark, it names the program as you've named it.

NEW PROGRAM. Last, let's look at listing 2 to see what the new program does.

In this short program which records a small geometrical shape, line 200 contains the jammed-together numbers of the coordinates of each PSET point to be turned on. Line 1000 has two loops. The first, FOR R=1 TO P, addresses each array value in the C(X) lines. The other loop goes through the C(X) material, hitting every fourth character. At each stop it turns the first two string numbers into the numeric value for the across point on the axis, the second two into the down value on the axis. Then it PSETs all these values.

That's it, except for a final bit of advice. The educational toy Etch-A-Sketch, described earlier, is erased by holding it up and shaking vigorously. All three children on whom I tested the short program Draw tried to do the same thing to the Model 100 when they wanted new displays. If capital punishment is outlawed in your state, you might be wise to drill the child briefly on depressing shift-break, then typing RUN and tapping enter to start a new display. ♣

```

270 C(8)="192020202120222026202720282029203020
3320342035203620372038201121122113211421182120
2122212421262128213021342135213621372112221822
2022222224222622282230223522"
280 C(9)="362237221223182322232423262330233723
1124182421242424272430243824112519252025242528
2529253825112615261626222624262626322633263826
1227152716272327242725273227"
290 C(10)="3327372713282428362814291929292935
291530203022302330243025302630283034301631213
122312331243125312631273133311532163223322432
25323232333214331533173331333333"
300 C(11)="3433133414341834303434343534123513
351935243529353535363511361236203628363636373
610371137213727373737383709381038223823382438
25382638383839380839093939394039"
310 C(12)="0740084040404140064107414141424105
420642234226424242434204430543434344430344044
4234426444444445440245034545454645014602464646
47460147474748470148484849480149"
320 C(13)="0249034904490549064907490849094910
491149124913491449154916491749184919492049214
922492349244925492649274928492949304931493249
33493449354936493749384939494049"
330 C(14)="414942494349444945494649474948494949"
1000 CLS
      :FOR R=1 TO P
      :FOR A=1 TO LEN(C(R))-3 STEP 4
      :G=VAL(MID$(C(R),A,2))
      :H=VAL(MID$(C(R),A+2,2))
      :PSET(G,H)
      :NEXT A,R
1010 GOTO 1010 ♣

```

Program Listing 4. Draw.

```

100 REM * Draw *

      TRS-80 Model 100 8K
      / Richard Ramella *
110 CLS
120 CLEAR 100
130 DEFSTR C
140 CLS
150 A=25
160 B=25
170 LINE(0,0)-(239,63),1,B
180 PSET(A,B)
190 C=INKEY$
200 IF C="" THEN 190
210 F=A
220 G=B
230 IF C="A" AND B>1 OR C="a" AND B>1 THEN B=B-1
240 IF C="Z" AND B<62 OR C="z" AND B<62 THEN B=B+1
250 IF C="<" AND A>1 OR C="," AND A>1 THEN A=A-1
260 IF C=">" AND A<238 OR C="." AND A<238 THEN A=A+1
270 H=ASC(C)
      :IF H=60 OR H=62 OR H=65 OR H=90 THEN PRESET(F,G)
280 PSET(A,B)
290 GOTO 190
300 END ♣

```


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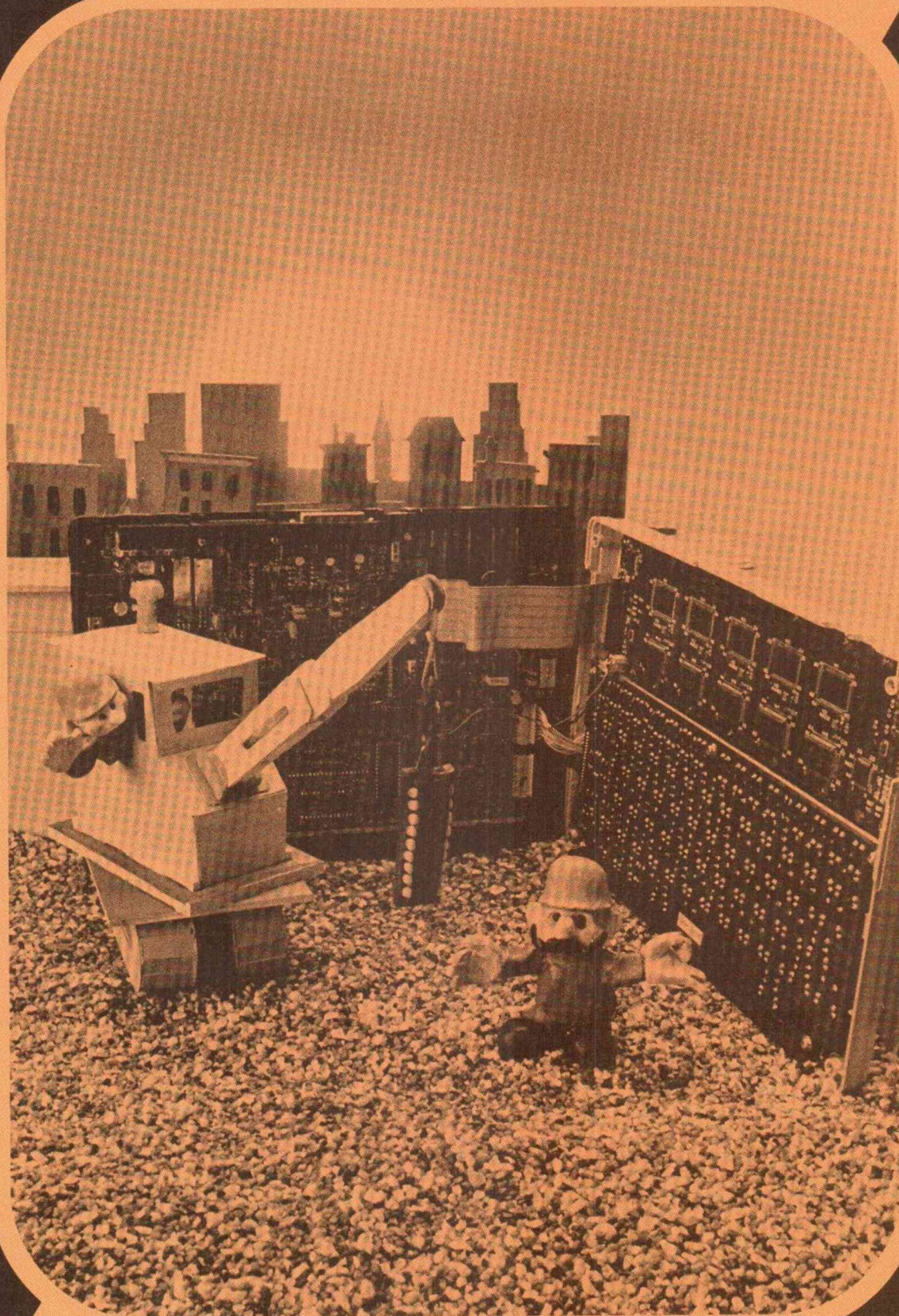
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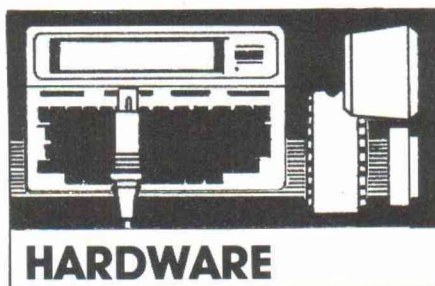
RAMP UP YOUR MEWS TO 32K WITH PLUG-IN CMOS

Even if the inside of a computer gives you cause to shudder, you can easily add memory to your 100.

By SCOTT L. NORMAN

You can never have too much memory. I think it's a good bet that additional RAM is the first "accessory" purchased by most owners of personal computers. I know memory upgrades were frequent acquisitions in the early days of my association with the TRS-80 Color Computer, and it was obvious to me from the beginning my Model 100 was going to be treated to as much memory as it could take. That's why I started off with a 24K machine, rather than testing the waters with 8K and building up slowly. After all, we have a lot of business to transact, my portable and I.

No matter which configuration you have, the need for more memory soon becomes real enough. The question is how to go about taking the next step. Radio Shack Service Centers can do the job for you — provided they have the necessary chips in stock and provided you don't mind paying top dollar. A number of independent vendors are offering 8K RAMs you can install yourself, though, and I thought it



might be of interest to show you how simple the job can be. After all, no one is immune to saving a little money — myself included.

Let me remind you why the topic of memory upgrades deserves an article at all. The Model 100's ability to run for hours at a time on dry-cell power, and its ability to retain information in RAM with the power "off," arise from its use of CMOS (Complementary Metal-Oxide Semiconductor) circuitry. Integrated circuits fabricated with CMOS technology are veritable misers when it comes to the use of electrical power.

CMOS CATCH. There's a catch, though: CMOS IC chips are fairly

sensitive to static electricity. Elaborate precautions are taken in CMOS fabrication facilities to ensure the circuits are not exposed to unexpected voltage surges during manufacturing, packaging, or testing. Workers wear special anti-static garments, walk on anti-static mats, and may even be grounded to their test equipment with special conductive "bracelets" and cables.

This need for caution has given CMOS circuitry a rather spooky reputation. Many Model 100 users — especially people with nontechnical backgrounds — have questioned whether anyone short of an interested circuit engineer can handle the chips at all. They are frequently concerned about the well-being of the entire computer, as well as for the add-on memory module.

Perhaps I can allay those fears. The purpose of this piece is to demonstrate that with just a little care, any Model 100 owner can upgrade the memory in his or her machine. Even "care" may be too strong a term; let's just say that a little common sense is all that's required. Don't wait until the relative humidity in your work area is hovering around the 20 percent mark, don't handle the chips while doing a soft-shoe dance on a wool carpet, don't go petting the cat while you're doing the upgrade, and you'll do just fine.

IOTA CHIPS. To get specific about the job illustrated in the accompanying photos, I recently used one of Iota Systems' 8K modules to bring my 24K machine up to 32K. Its \$85 price tag takes the module out of the pocket change category; I prefer to think of it as costing just over a penny per byte! In any event, you can save up to \$50, relative to Radio Shack's list price, by doing the upgrade yourself.

My computer was already equipped with a socket to plug in the module. The whole job came down to a matter of opening up the Model 100's case, plugging a memory module into its socket in the correct orientation (there are only two possibilities), and buttoning everything back up. Should you attempt the job, just remember it's necessary to save all of your programs and data files to tape first, since the computer's memory switch has to be turned off. That certainly shouldn't present a problem, and Iota Systems' brief instruction leaflet will scarcely let you go wrong in any of the other steps.

The photographs and their captions tell the story pretty well, I think. I would just like to add a few remarks.

First, the memory chips supplied by Iota are exactly the same as those used by the manufacturer in the first place: Hitachi 6117s. Each 8K module consists of two chips bonded to a ceramic substrate — the arrangement used in the original memory. There's no need to be concerned about getting inferior merchandise.



Photo 1. Everything you need for your upgrade.

KITCHEN TABLE JOB. In the second place, note this really is a kitchen table job, that's the Norman family table (and kitchen) in the photos. The only major precaution in sight is the towel I used to cover the work surface; this provides scratch protection for both the Model 100's display and the table itself. No elaborate anti-static precautions were used.

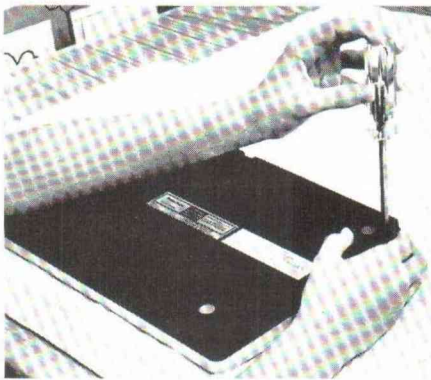


Photo 2. Disassembling your Model 100.

PHOTO 1. Now, let's get to the upgrade process itself. Photo 1 is a portrait of everything needed to do the job. And then some: the Model 100 itself, the Iota Systems memory module sitting in its protective case, the perfectly clear instruction leaflet, and a pair of screwdrivers. Actually, only the Phillips screwdriver nearest the camera is really required; I just used the second one to help seat the module in its socket.

PHOTO 2. Once the memory power switch on the bottom of the computer has been set to the off position, you can proceed to open up the case. The AA cells can be left in place. There is one Phillips head screw in each corner; unscrew them until they are loose in their recessed sockets, then turn the computer right side up and let the screws fall onto the towel.



Photo 3. Loosening the 100's halves.

PHOTO 3. Now you can actually separate the halves of the case. Pry them apart by hand; the instructions caution you against using a screwdriver or other tool, which might damage some of the internal components. Your fingernails are really enough to get things started. I found it best to take it easy and slip the top off in stages; I wound up working my way around the case twice before the two parts were clear of each other. A word of warning: don't try to separate the two sections of the machine by any great distance; they are connected by cables which have very little slack. Just lift the top and swing it to the right, as though you were opening the back cover of a book.

AFTER YOUR RAM'S IN, TEST IT WITH THIS PROGRAM

```

10 REM RAM TEST PROGRAM : VERSION 1.0
15 REM JULY 31, 1983
20 REM IOTA SYSTEMS
30 REM 75655,1360
40 REM written by GARY MUHONEN
50 REM THIS PROGRAM TESTS THE OPTIONAL
60 REM RAM IN THE MODEL 100. IT TESTS
70 REM THE OPTIONAL 8K RAM 1,2, and 3 AT
80 REM HEX ADDRESSES C000, A000, and
90 REM E000. RESPECTFULLY, THIS PROGRAM
100 REM DOES NOT TEST THE 0th 8K RAM AT
110 REM E000, AS THIS PROGRAM RESIDES
112 REM THERE. (NOTE: THE 0th RAM
114 REM MODULE IS THE FIRST 8K RAM
116 REM MODULE, AND IT IS THE ONE IN A
117 REM STANDARD 8K MODEL 100 FROM
118 REM RADIO SHACK.
120 REM THIS PROGRAM CLEARS
130 REM ALL OF THE FILES IN THE MODEL
140 REM 100, AND A HARD RESET
150 REM (CTRL-PAUSE-RESET) IS REQUIRED
160 REM TO RESTART THE SYSTEM.
170 REM ***** BACK UP ALL FILES *****
180 REM ***** BEFORE RUNNING *****
190 REM ***** THIS PROGRAM *****
195 CLS
200 PRINT "IOTA SYSTEMS RAM TEST PROGRAM"
210 PRINT "THIS PROGRAM TESTS"
220 PRINT "OPTIONAL RAM #1 (C000-DFFF), 8k to 16k"
230 PRINT "2 (A000-BFFF), 16k to 24k"
240 PRINT "3 (8000-9FFF), 24k to 32k"
250 PRINT
260 PRINT "PRESS ANY KEY TO CONTINUE..."
270 K$=INPUT$(1)
275 CLS
280 PRINT "THE PROGRAM WILL TELL YOU WHICH"
290 PRINT "RAMS TEST GOOD, AND THOSE WHICH TEST"
300 PRINT "BAD. MISSING RAM MODULES WILL"
310 PRINT "TEST AS BEING BAD."
320 PRINT
330 PRINT "PRESS ANY KEY TO CONTINUE..."
335 AS=INPUT$(1)
336 CLS
340 PRINT "THIS RAM TESTER WILL DESTROY ALL"
350 PRINT "PROGRAMS IN THE COMPUTER, SO YOU MUST"
360 PRINT "SAVE ALL OF YOUR PROGRAMS TO CASSETTE"
370 PRINT "(OR DISK) INCLUDING THIS PROGRAM,"
380 PRINT "BEFORE RUNNING THIS PROGRAM."
390 PRINT
400 PRINT "PRESS ANY KEY TO CONTINUE..."
410 AS=INPUT$(1)
420 CLS
430 PRINT "TO END THE RAM TEST PROGRAM, PERFORM"
440 PRINT "A HARD RESET. THIS IS DONE BY"
450 PRINT "PRESSING CTRL-PAUSE-RESET ALL AT ONCE."
460 PRINT "OR HOLD CTRL-PAUSE AND TURN THE"
470 PRINT "COMPUTER OFF AND THEN ON."
475 PRINT
480 PRINT "DO YOU WANT TO START THE RAM-TESTER?"
490 AS=INPUT$(1)
492 IF AS="N" OR AS="n" THEN STOP
494 IF AS="Y" OR AS="y" THEN GOTO 500
496 BEEP : GOTO 480
500 REM WRITE MACHINE PROGRAM TO MEMORY AT E100 (HEX)
505 CLS : PRINT "WRITING BINARY PROGRAM TO MEMORY..."
510 FOR I=57600 TO 57801
520 READ J
530 POKE I,J
540 NEXT I
600 REM CALL THE MACHINE RAM TEST PROGRAM
610 CALL 57600
1000 DATA 205,49,66,30,18,205,21,225,30,33,205,21,225,30,48,205
1010 DATA 21,225,195,3,225,205,131,225,6,0,205,111,225,205,82,225
1020 DATA 194,61,225,6,255,205,111,225,205,82,225,194,61,225,6,7
1030 DATA 205,111,225,205,82,225,194,61,225,205,169,225,201,205,183,225
1040 DATA 201,123,230,15,7,7,7,7,198,128,103,198,32,87,46,00,201
1050 DATA 205,65,225,72,62,7,184,194,94,225,129,79,121,190,202,102
1060 DATA 225,62,1,201,35,122,188,194,86,225,62,0,201,205,65,225
1070 DATA 72,62,7,184,194,123,225,129,79,113,35,122,188,194,115,225
1080 DATA 201,62,82,205,68,75,62,65,205,68,75,62,77,205,68,75
1090 DATA 62,32,205,68,75,123,230,240,15,15,15,198,48,205,68,75,62,32
1095 DATA 205,68,75
1100 DATA 201,62,79,205,68,75,62,75,205,68,75,205,34,66,201,62
1110 DATA 66,205,68,75,62,65,205,68,75,62,68,205,68,75,205,34
1120 DATA 66,201

```

WHERE TO GET CMOS RAM

Tandy Corporation
1500 Tandy Center
Fort Worth, TX 76102
\$119.95 plus installation for each 8K RAM

Holmes Engineering, Inc.
5175 Green Pine Drive
Salt Lake City, UT 84107
801-261-5652
24 Hr. BBS 801-268-1103
8K RAM \$75.00 each
2 or more \$70.00 each

Purple Computing
4807 Calle Alto
Camarillo, CA 93010
805-987-478
8K RAM
\$69.95

PG Design Electronics
66040 Gratiot
Richmond, MI 48062
313-293-6639
8K RAM
\$64.95 each
3 or more \$59.95 each

Iota Systems
1690 Day Valley Road
Aptos, CA 95003
408-684-0482
8K RAM \$85.00 each
2 or more \$80.00 each

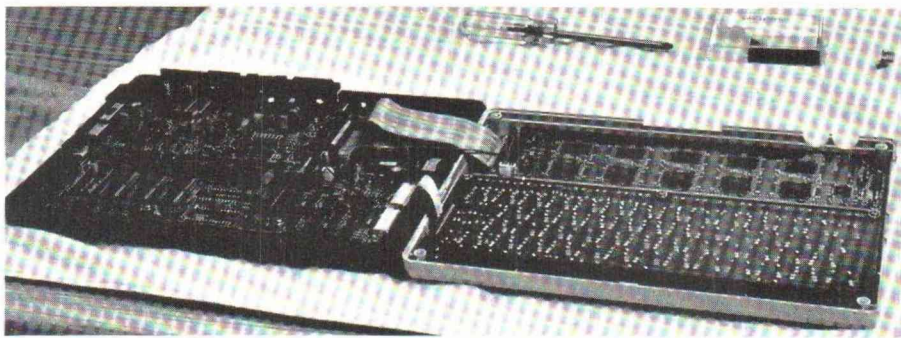


Photo 4. The inside of your 100.

PHOTO 4. Now the machine is open. The keyboard and display are in the right-hand section (keyboard toward the camera). Note the short, flat cables which link the two printed circuit boards; they limit your freedom to move the two parts of the Model 100.

PHOTO 5. My daughter is pointing to the expansion RAM socket. The "stock" RAMs are located just to the right of her finger: three, two-chip modules soldered to the printed circuit board. An 8K machine would have one soldered module and three empty sockets. The sockets are clearly marked; if you are upgrading from 8K to 16K or 24K, you must be careful to insert the new RAMs in the proper spaces. The Iota instructions include sketches of the proper arrangement.

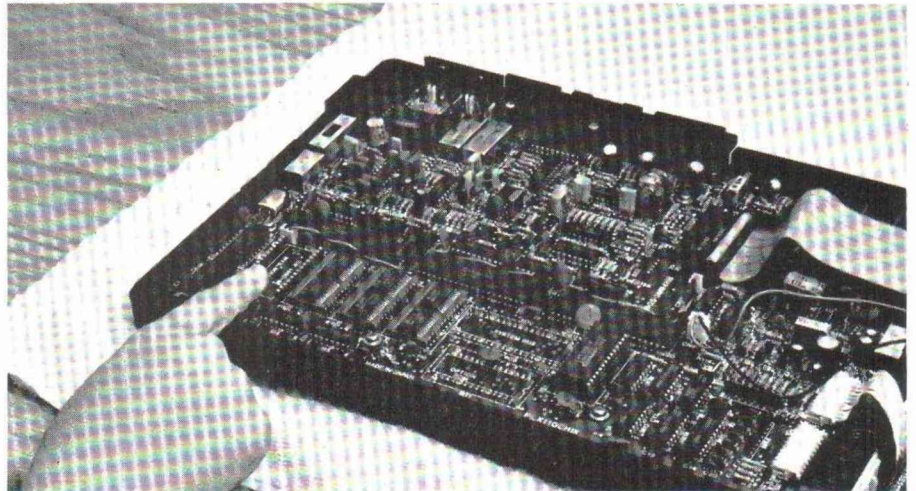


Photo 5. Socket for CMOS chip.

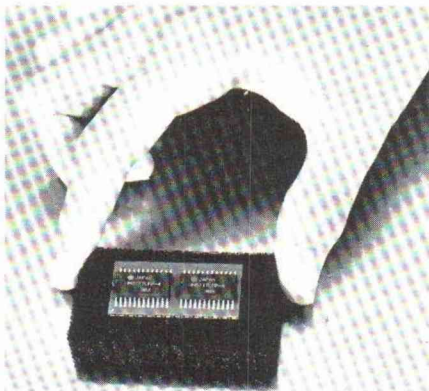


Photo 6. CMOS RAM as packaged by Iota.

PHOTO 6. This is the memory module. The two CMOS chips are bonded to a 26-pin ceramic substrate, and the whole thing is shipped "plugged in" to a block of conductive polyurethane foam. There's a small notch in the left-hand edge of the substrate, which should point toward the bottom of the Model 100's case when the module is installed. Once again, just notice which way the notch points in your computer's stock memory.

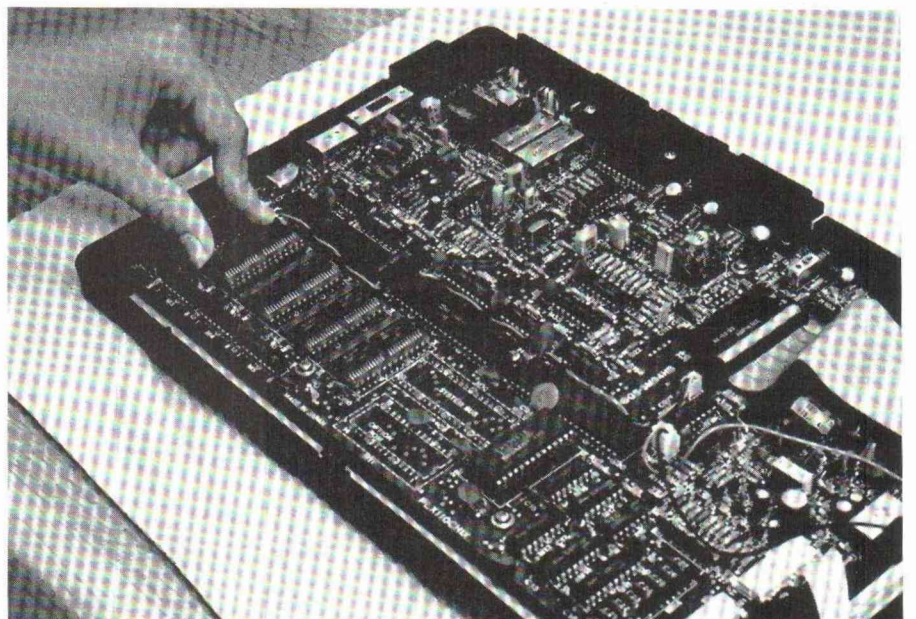


Photo 7. Seating new memory.

PHOTO 7. Plugging in. You can minimize any worries about damaging the chips by handling only the ceramic substrate. Take your time

and work the module down into its socket a little at a time. My technique for inserting ICs is to "rock" them into place after lightly inserting all pins.

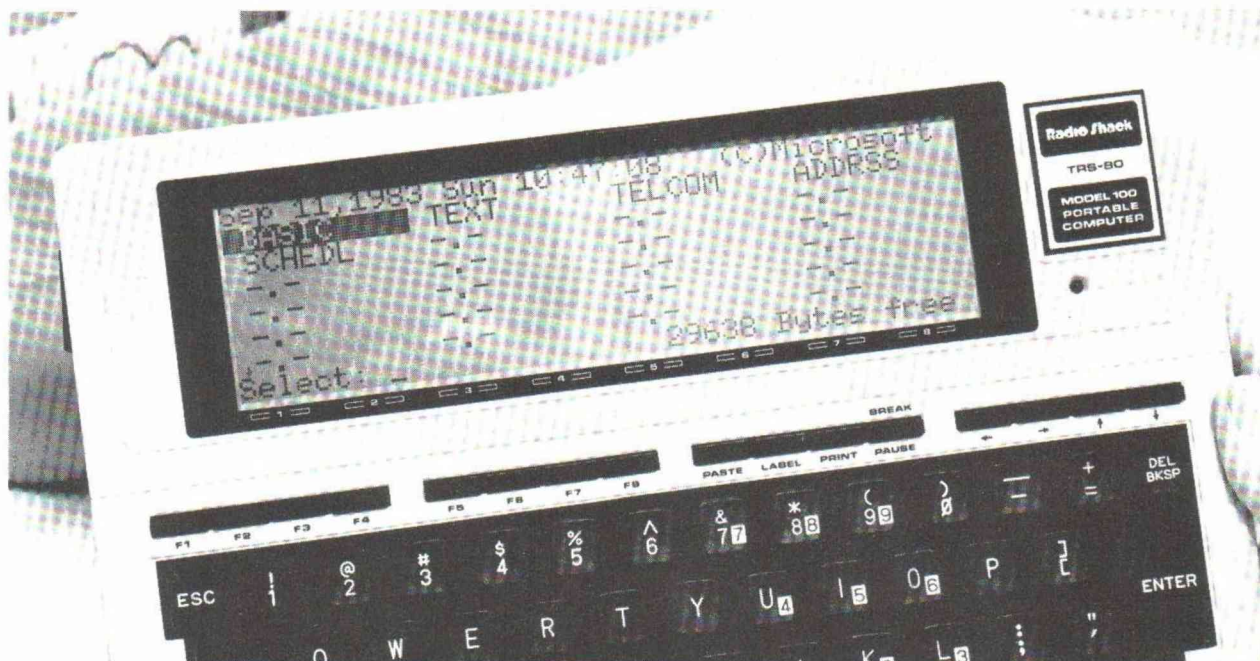


Photo 8. The magic number.

PHOTO 8. With the new RAM in place, the computer can be reassembled (watch those cables!) and the memory power switch turned ON again. Then it's time to turn on the regular power switch. Notice the

29638 bytes of free memory; that's the "magic number" for a 32K machine.

I told you it was a simple job. Just to be on the safe side, though, everyone should have a memory-test program to diagnose any flaws that might arise. There are a number of such programs making the rounds

these days, including one on the CompuServe Model 100 SIG. That program was kindly provided by Sheri Talbott of Iota Systems and is listed here (see program listing). The documentation is contained in the listing. Note any programs in RAM will be destroyed by the tester and should be saved on tape first. **4**

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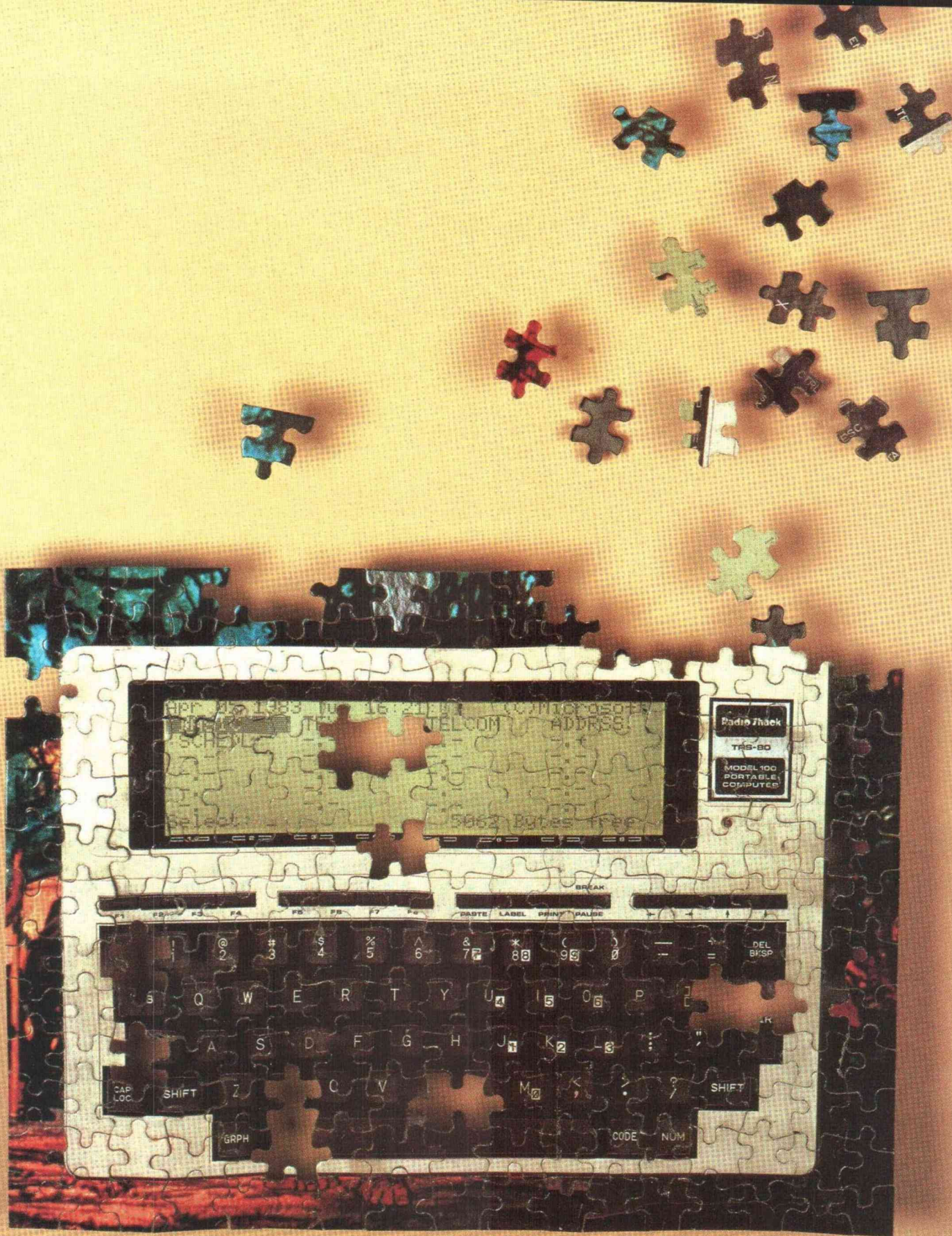
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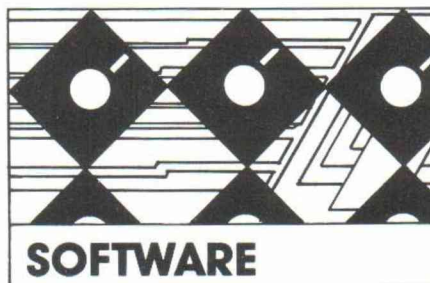
DISASSEMBLING THE PUZZLE IN YOUR 100'S ROM

For our readers who wish to follow in Jake's footsteps, here's an opportunity from the old disassembler himself.

By JAKE COMMANDER

After recounting the confessions of a midnight disassembler in my column month before last, this article becomes highly appropriate. The accompanying program, written in Basic, allows everyone the opportunity to disassemble machine code on the Model 100 and spend many a bleary-eyed hour poring over the output. Apart from a few minor changes, this is the program used to produce my gargantuan 32K ROM listing, so I can testify to its accuracy.

A disassembler has other uses than plodding through ROM of course. It can be invaluable when checking machine code that's been entered manually without an assembler. This is when code is POKEd from Basic, using data or input statements. Finding the correct numbers to POKE usually involves cross-referencing the machine opcodes from a book and building up a list of numbers. Otherwise known as hand-assembly, this is an unenviable task and is extremely error-prone (increasingly so with longer programs). A disassembler provides an invaluable



aid in checking such code before letting it fly with the microprocessor. Remember, there's no such thing as error-trapping in machine code. More often than not, a crash leaves your machine sitting there with frazzled brains and no indication as to what went wrong. A disassembly of the code allows a thorough check to be made before its execution and is easier to check than a raw list of numbers.

LACKING ROUTINE. Another use for a disassembler is in analyzing other people's code. This is not really any different from scanning and possibly altering other people's Basic code. Machine-code programs are often frustratingly short of a particular feature and a disassembler

gives you the chance to locate the routine that's lacking. If the routine is in RAM, a patch can be incorporated and a permanent change made to the program.

Of course, if you really are a sucker for punishment, you can always disassemble and comment the Model 100 ROM. Seriously, 32K of code would be nigh on impossible without a disassembler — imagine trying to follow the logical interconnection and flow of 32,768 separate numbers! So much for the benefits of a disassembler in general — on to this one in particular.

One of the first things to note is this is a true 8085 disassembler — not a revamped Z80 version. Like it or not, the Model 100 is under the control of an 8085 MPU, so you may as well speak its language. Using Z80 machine-code mnemonics is OK as a stop-gap measure in looking at 8085 code, but it should only be a stop-gap measure. For a start, there are special 8085 mnemonics in its instruction set — RIM (read interrupt masks) and SIM (set interrupt masks) — which don't properly translate into 8080 or Z80 mnemonics. If you don't take steps to get used to 8080/8085 assembly language, you're going to be at a loss when confronted with an assembly or disassembled listing. Don't kid yourself if you're a Z80 programmer — dive in and learn those unfriendly Intel mnemonics.

PRINT USING BUG. The program itself is pretty straightforward. The main work of disassembly occurs between lines 30 to 900. Line 900 prints each line with a PRINT USING statement. I've taken the precaution of using a literal string in this statement because there is a reported bug when the function is invoked with a string variable as a field specifier. This statement can be easily modified to change the output format — just alter that field specifier literal.

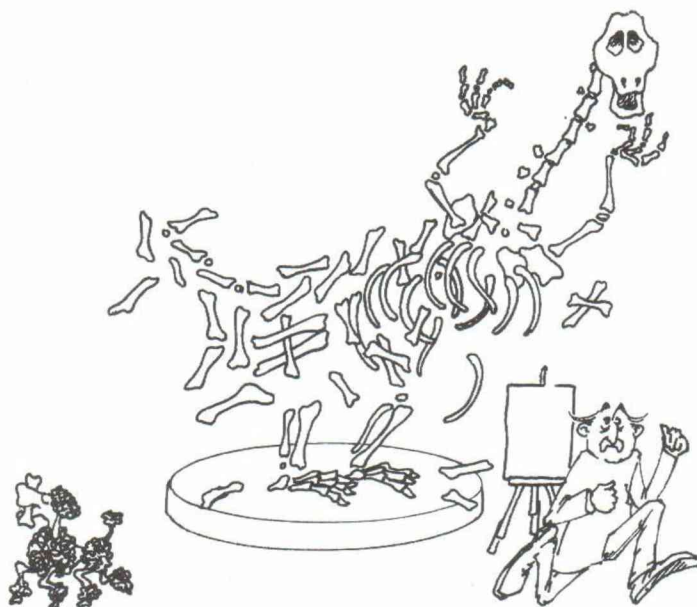
Five columns are used in each disassembly output line. The first column is the hexadecimal address of the opcode at each line. Second is a column containing the byte or bytes of the opcode itself. Third is the mnemonic of that opcode as originally specified by Intel Corporation. Fourth is the operand (if any) used by the operation. (This can be an 8085 register name, an address in memory, or a combination of the two.) In the fifth column, I've added a feature purely for convenience. A comment will be placed here displaying any ASCII character used as an operand in a CPI or MVI opcode. This can be especially helpful in unravelling un-

familiar routines.

Lines 10 to 25 request the parameters to be used by the program. First, a prompt is issued for the address range of the disassembly. This should be entered in hexadecimal, with upper and lower case being acceptable. A check is made to see that

valid hexadecimal characters were entered and the end address is higher than the start address. The prompt will be repeated if an error is detected.

Secondly, a prompt is given for an output file name. Hitting the enter key at this point sends the listing to the Model 100's display. If you want



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a hard copy, type LPT:(enter). File specifications can be anything conforming to the regular Model 100 format. For instance, a six or less character filename will send the output to a RAM text file with a .DO extension. This is where the simplicity of the machine's file handling comes into its own. The output can be sent to any device just by specifying a valid device name at the second prompt.

HEX CONVERSION. Lines 1000 to 1050 perform conversion from hexadecimal to decimal. Q\$ is the input and Q is the output. Q will contain -1 if the string Q\$ doesn't contain a valid hex address. Lines 2000 to 2060 perform the conversion the other way round. Q is the decimal input, and Q\$ is returned to the caller with a two or four character hex string. Other Intel-type formatting such as adding "+" or "-" signs or appending "H" as appropriate is accomplished in lines 2000 onwards.

When confronted with a disassembly, here are some hints which can help with a cold disassembly.

For a start, no serious work will be accomplished without a printout.

Once you've got this, break the task down into manageable chunks. Look for RET and JMP opcodes; these can be regarded almost as periods at the end of sentences. They often represent the end of a section of code. Take a ruler and draw a line under such instructions—it breaks up a disassembly into its constituent parts which you can attack section by section. The disassembler could even be modified to automatically draw such a separating line.

Opcodes are another thing to be on the lookout for. It's because these are so important that I incorporated the comment column with ASCII codes. CPI means "compare immediate"; the code at this point is asking a question. By knowing what the question is, you have some understanding of what is happening at that point in the code.

CONDITIONAL JUMP. The occurrence of a conditional jump is another of the more usable clues. If CPI instructions are the most obvious forms of question posed by the code, then conditional jumps are the most obvious forms of answer. Take this

piece of code from the Model 100 ROM:

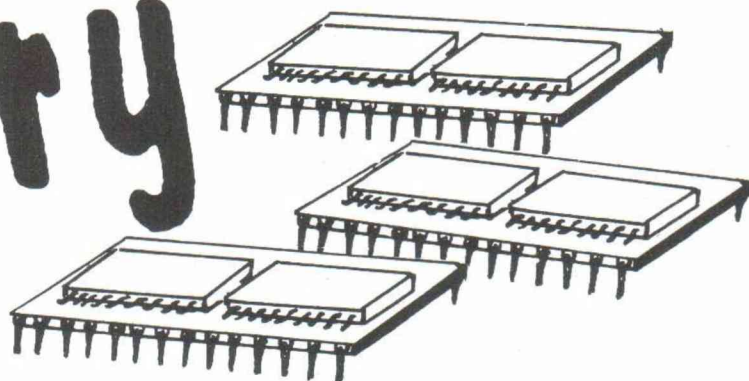
```
4DCFFE 4D CPI 4DH ;="M"
4DD1 CA CC 22JZ 22CCH
```

The first line of code is asking, "Is the character in the A register an 'M'?" The second line answers, "If it is, then jump to location 22CC hex." These five bytes are taken from the section of Model 100 ROM which distinguishes between a Basic SAVE or SAVEM instruction.

Unfortunately, not all sections of machine code are so obvious, but at least a start can be made by looking for the easy bits. Without a disassembler though, you'd spend an inordinate amount of time finding these slices of code. In fact, with a large project, it takes less time to write a disassembler from scratch than it does to hand-disassemble hundreds or thousands of bytes.

From now on, when your mouth waters at the thought of all that juicy machine code waiting for you, you'll be ready to pounce on the opportunity. I've provided the disassembler. All you have to do is provide the gray matter. ▀

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10 DEFSNGA-Z

:CLS
:INPUT "Hex start, end";SS,ES

15 QS=RIGHT\$("0000"+SS,4)

:GOSUB1000
:AD=Q
:QS=RIGHT\$("0000"+ES,4)
:GOSUB1000
:E=Q

20 IFAD=-1ORE=-1THEN10ELSELINEINPUT "Output File?";FS

:IFFS=" "THENFS="LCD:"

25 OPENFSFOROUTPUTAS1
30 IFAD>ETHEENELSEQ=AD

:GOSUB2010
:L1\$=QS
:L3\$=" "
:L4\$=" "
:L5\$=" "

40 OP=PEEK(AD)

:AD=AD+1
:Q=OP
:GOSUB2000
:L2\$=QS

50 IFOP>191THEN600
60 IFOP<64THEN300
100 IFOP>127THEN200

110 IFOP=118THENL3\$="HLT"
:GOTO900

120 L3\$="MOV"
130 Q=(OPAND56)/8

:GOSUB2100
:L4\$=QS+" "
:Q=OPAND7
:GOSUB2100
:L4\$=L4\$+QS

140 GOTO900

200 L3\$=MID\$("ADDADCSUBSBBANAXRAORACMP",
(OPAND56)/8*3+1,3)

210 Q=OPAND7

:GOSUB2100
:L4\$=QS
:GOTO900

300 ON(OPAND15)+1

GOTO320,340,360,380,400,420,440,460,
480,500,520,540,400,420,440,560

320 IFOP=16THEN480ELSEL3\$=MID\$("NOPDB

RIMSIM", (OPAND48)/16*3+1,3)

:GOTO900

340 L3\$="LXI"
350 GOSUB2200


```

:L4$=Q$+","
:GOTO375
360 IFOP<=18THENL3$="STAX"ELSE370
365 L4$=MID$("BD",(OPAND16)/16+1,1)
:GOTO900
370 IFOP=34THENL3$="SHLD"ELSEL3$="STA"
375 GOSUB2300
:L4$=L4$+Q$
:GOTO900
380 L3$="INX"

390 GOSUB2200
:L4$=Q$
:GOTO900
400 L3$="INR"
410 Q=(OPAND56)/8
:GOSUB2100
:L4$=Q$
:GOTO900
420 L3$="DCR"
:GOTO410
440 L3$="MVI"

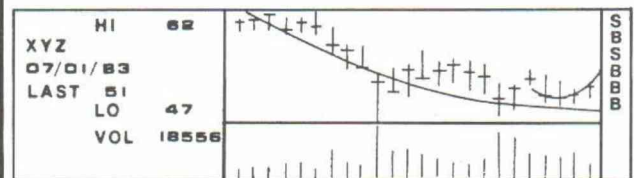
450 Q=(OPAND56)/8
:GOSUB2100
:L4$=Q$+","
455 GOSUB2310
:L4$=L4$+Q$
:GOTO900
460 L3$=MID$("RLCRALDAASTC",(OPAND56)/
16*3+1,3)
:GOTO900

480 L3$="DB"
490 L4$=L2$+"H"
:GOTO900
500 L3$="DAD"
:GOTO390
520 IFOP<42THENL3$="LDAX"
:GOTO365
530 IFOP=42THENL3$="LHLD"
:GOTO375ELSEL3$="LDA"
:GOTO375

540 L3$="DCX"
:GOTO390
560 L3$=MID$("RRCRARC MACMC",(OPAND48)
/16*3+1,3)
:GOTO900
600 Q1=(QAND7)
:IFQ1=7THEN700ELSEIFQ1MOD2=1THEN720ELSE
ONQ1/2+1
GOTO620,640,660,680

620 L3$=MID$("RNZRZ RNCRC RPORPERP RM",
(OPAND56)/8*3+1,3)
:GOTO900
640 L3$=MID$("JNZJZ JNCJC JPOJPEJP JM",

```



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```
(OPAND56)/8*3+1,3
:GOTO375
```

```
660 L3$=MID$("CNZCZ CNCCC CPOCPECP CM",
(OPAND56)/8*3+1,3)
:GOTO375
```

```
680 L3$=MID$("ADIACISUISBIANIXRIORICPI",
(OPAND56)/8*3+1,3)
:GOTO455
```

```
700 L3$="RST"
L4$=CHR$(48+(OPAND56)/8)
:GOTO900
```

```
720 Q1=OPAND15
:IFQ1=13THEN780ELSEIFQ1=9THEN760
ELSE
IFQ1=5THEN740ELSEIFQ1<>1THEN800
```

```
730 L3$="POP"
:GOTO750
```

```
740 L3$="PUSH"
750 L4$=MID$("BDHP", (OPAND48)/16+1,1)
:IFL4$="P"THENL4$="PSW"
:GOTO900ELSE900
```

```
760 IFOP=201THENL3$="RET"
:GOTO900ELSEIFOP=217THEN480ELSE
IFOP=23THENL3$="PCHL"
:GOTO900ELSEL3$="SPHL"
:GOTO900
```

```
780 IFOP=205THENL3$="CALL"
:GOTO375ELSE480
```

```
800 ON(OPAND60)/8+1GOTO810,480,820,830,840,
850,860,870
```

```
810 L3$="JMP"
:GOTO375
```

```
820 L3$="OUT"
:GOTO455
```

```
830 L3$="IN"
:GOTO455
```

```
840 L3$="XTHL"
:GOTO900
```

```
850 L3$="XCHG"
:GOTO900
```

```
860 L3$="DI"
:GOTO900
```

```
870 L3$="EI"
:GOTO900
```

```
900 PRINT#1,USING "
";L1$;L2$;L3$;L4$;L5$
:GOTO30
```

```
1000 Q=0
:Q2=LEN(Q$)
:IFQ2=0THENRETURN
```

```
1010 Q1$=Q$
:FORQ1=Q2TO1STEP-1
Q$=MID$(Q1$,Q1,1)
```



```

1015 IFQ$>="0"ANDQ$<="9"THEN1030
1020 IFQ$>"F"THENIFQ$>=
      "a"ANDQ$<="f"THENQ$=CHR$(ASC(Q$)-32)*
1025 IFQ$<"A"ORQ$>"F"THEN1050

1030 Q3=ASC(Q$)
      :IFQ3>57THENQ3=Q3-7
1040 Q=Q+16 (Q2-Q1)*(Q3-48)
      :NEXT
      :RETURN
1050 Q=-1
      :RETURN

2000 Q$=""
      :Q1=Q
      :GOTO2030
2005 Q1=Q:Q$="+"
      :IFQ>127THENQ1=256-Q
      :Q$="-"

2007 GOTO2030
2010 Q$=""
      :QH=INT(Q/256)
      :QL=Q-QH*256
2020 Q1=QH
      :GOSUB2030
      :Q1=QL

2030 Q2=INT(Q1/16)
      :GOSUB2050
2040 Q2=Q1MOD16
2050 Q3=Q2
      :IFQ3>9THENQ3=Q3+7

2060 Q$=Q$+CHR$(Q3+48)
      :RETURN
2100 Q$=MID$( "BCDEHLMA",Q+1,1)
      :RETURN
2200 Q$=MID$( "BDHS", (OPAND48)/16+1,1)
      :IFQ$="S"THENQ$="SP"
      :RETURNELSERETURN

2300 Q=PEEK(AD)+PEEK(AD+1)*256
      :AD=AD+2
      :GOSUB2010
      :L2$=L2$+" "+RIGHT$(Q$,2)+" "+LEFT$(Q$,2)
      :Q$=Q$+"H"
      :IFQ<49152THENRETURNELSEQ$="0"+Q$
      :RETURN

2310 Q=PEEK(AD)
      :AD=AD+1
      :GOSUB2000
      :L2$=L2$+" "+Q$
      :IFQ>159THENQ$="0"+Q$

2330 Q$=Q$+"H"
      :IFQ>=32ANDQ<128
      THENL5$=" "+CHR$(34)+CHR$(Q)CHR$(34)
      :RETURNELSERETURN

```

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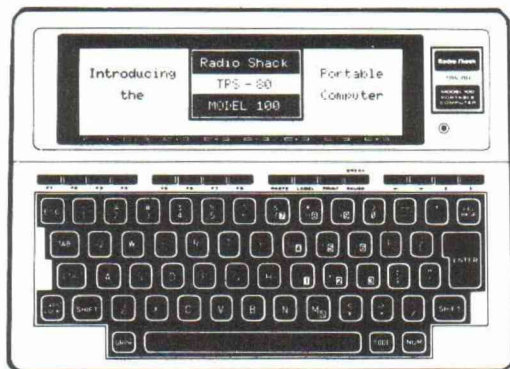
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K. W. Klages of Orlando, FL, was pretty excited when he saw David Busch's "Invisible Maze" (September 1983, page 50). But whenever he used the down arrow the cursor did not erase as it went along. And occasionally a minus sign would appear in front of the time clock. Happily, his son Kim knows a bit about programming and found the following changes fixed the bugs.

```
70 DEFINT A-Z
   :DIMMZ(320)
800 S=(FS+(FM*60)+(FH*3600))-(SS+(SM*
   60)+(SH*3600))
810 DM=INT(S=-INT(S/3600)*3600)/60
820 DS=INT(S-INT(S/60)*60)
```

MARKET-100. Edwin Dethlefsen's program Market-100 (September 1983, page 41) had a few problem spots as well. Change these lines to read as follows:

```
390 GOSUB200
   :PRINT "You own ";A;" shares";A$;
   ", Correct?(Y/N)"
700 PRINT#1,K;D(I);
   :CLOSE
   :RETURN
710 CLS
   :GOSUB200
830 PRINT@1,"Date";
   :PRINT@8,"Price";
   :PRINT@21,"Date";
   :PRINT@28,"Price"
1030 IFJ<10THENPRINT@L,J;ELSEPRINT@L,"$";
1300 PRINTUSING " ";A$(I);
1320 PRINTUSING "#####";C(I)-CC(I)
```

Run the program with your caps lock on, as it does not recognize lowercase responses to prompts.

BUSCH LEAGUE



COMPUTER ASSISTED DESIGN "WITHOUT ANY PRACTICAL APPLICATION"

Editor's Note: Dave's column is based on his 25 Games for Your Model 100 published by Tab Books of Blue Ridge Summit, PA 17214.

Computer Assisted Design or Computer Assisted Drafting (CAD), is changing the way architects, engineers and designers work. Instead of laboriously drafting on paper, those professionals manipulate images on a CRT screen.

The Model 100 can also be used to draw images on its liquid crystal display screen. However, because this is a "games" book rather than an "applications" book, I have carefully designed the program "Sketch" so it has no practical application.

There are a number of ways of drawing on the Model 100. Up until this point, we have used only the PRINT and "PRINT @" statement to place alphanumerics and graphics on the screen. When PRINT @ statements are followed by a semicolon, the screen does not scroll. Therefore, it is possible to move objects around on the screen quite quickly. If the previous position is erased after moving the object to a new PRINT @ location, the appearance is the object has moved from one place to the other.

LO-RES. The problem with PRINT @ drawing is the lack of resolution. There are 320 PRINT @ positions on the screen, making up a matrix that is 40 picture elements wide and eight picture elements deep. This gives

new meaning to the term "lo-res."

However, the Model 100 does have another mode, which allows turning on or off any of the 15,360 individual liquid crystal blocks, or pixels, on the screen. This array measures a more usable 240 across by 64 deep. For those of you familiar with the TRS-80 Models I/III and 4 (Model III mode), the Model 100's resolution is roughly 2 1/2 times better, although the aspect ratio is different.

These pixels are turned on using the PSET statement, and turned off via PRESET. Simply use the X and Y coordinates of the rectangle you want to switch, e.g., PSET(11,23). Variables may also be substituted. To draw a line do this:

```
10 FORN=1 to 10
:PSET(10,N)
:NEXTN
```

Yet another drawing mode can be accessed, using the LINE command. Here, two sets of coordinates must be entered, representing the starting point and ending point of the line. LINE (20,20)-(30,30) will draw a diagonal line on the screen. LINE (20,20)-(20,40) will draw a horizontal line, while LINE (20,20)-(30,20) will etch a vertical line on the screen.

SWITCHES. LINE gets even more interesting because it can be followed by a switch. Odd switches (or no switch) tells Basic to set the pixels in the line, while even values (e.g., LINE (20,20)-(30,30),2) reset the pixels or turn them off.

But, as the TV pitchman says, Wait! There's more! You also get to use a second set of switches, "B" and "BF." The first draws a box with corners at the coordinates given. The second, "BF" fills in all the points inside that box.

"Sketch" uses both PSET and LINE for its drawing routines. It has, in fact, two modes. The first

VARIABLES USED IN SKETCH

AS	Used in INKEY\$ loop
A	Value of AS
DL	Current delay value
DM	Dummy variable for RND(1)
FLAG	Flag showing ON-OFF condition
N	Loop counter
OG	Original delay value
PO	Shows how many points have been set
X	Maximum movement allowed in X axis
X1	X axis position of cursor
X2	X axis position of first point set
Y	Maximum movement allowed in Y axis
Y1	Y axis position of cursor
Y2	Y axis position of first point set
YD	Y axis movement
XD	X axis movement

ACCOUNTS RECEIVABLE PROGRAM

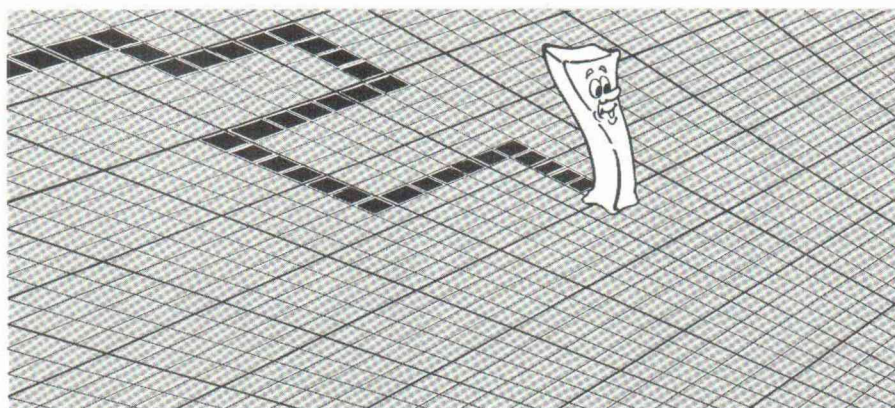
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uses only PSET. The cursor moves around the screen, leaving a trail of turned on pixels. If you wish, the cursor can be switched into PRESET mode by touching the space bar. Then, although the cursor will still be visible, it will leave blank pixels wherever it goes.

It may be turned back on by touching the space bar again. The space bar serves as what is called a "toggle" in computer slang. Hitting it forces the opposite of whatever mode the program happens to be in.

ETCH-A-SKETCH. "Sketch" mode turns the Model 100 into the world's most expensive "Etch-a-Sketch." The cursor direction is controlled by the arrow keys, and its speed can be changed at will, within limits. An initial speed is set by the operator when the program is run. The cursor can be slowed down from this speed or returned to it at any time, but it can never exceed the speed requested at first. Slowing is accomplished by hitting a number key, with the larger numbers providing more delay. Pressing the F key returns the cursor to full speed.

"Draft" mode allows the operator to set one point and when the second point is set, a line is drawn between them. The program then pauses, awaiting input of either S, which sets the first point of the next line, or an arrow key, which starts the cursor moving in a new, or the same direction. If you have drawn a line and want the new line to commence at the end of the old line, hit S before starting off. If you would prefer to start the new line some other place, hit an arrow key instead. Then, press S at the first point of the new line. The next time S is pressed, the line will be drawn automatically.

"Sketch" begins with the player entering the amount of delay de-

sired. This value is multiplied by 10 to produce a delay of 10 to 90. Variable OG keeps track of the amount of delay originally set (line 320), so that the program can return to this as necessary. The actual delay used in the for-next loop is defined as DL, and can be changed in value during program execution.

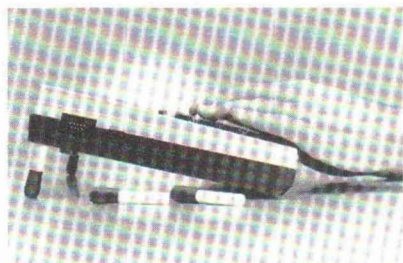
INKEY LOOP. If Sketch is selected, the program directs control to line 490, where an INKEY\$ loop begins. Each time through the loop, the X and Y coordinates of the next pixel to be set or reset may be altered, depending on what arrow key was pressed last. The variables storing the X and Y coordinates have been given the names XD and YD. If the right or left arrow keys were pressed last, then XD will have a value of 1 or -1, respectively. YD will equal zero.

If the up or down arrow keys were pressed last, then XD will equal zero, and YD will be either -1 or 1. Thus, each time through the INKEY\$ loop, the location of the next pixel to be turned on or off will be adjusted. Checks are made in lines 500 and 520 to make sure movement is not going off the Model 100's screen.

Actual setting or resetting is done in lines 560 or 570, depending on the value of variable flag. This variable is set to one each time the user switches from cursor off mode to cursor on mode. When FLAG=1, the program skips line 560, and instead runs line 570, which turns the pixel on. When FLAG=0, line 560 sets the pixel (so the user can see where the cursor is moving), waits for a for-next loop of 1 to 100, then turns the pixel off before moving on.

All this happens between lines 490 and 580 when no key is pressed. When the user hits a key, control drops down to line 590, where a

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check is made to see if the key pressed was a number key. If so, the delay variable, DL, is multiplied times the value of the key pressed, thus increasing the delay.

DRAFT MODE. Otherwise the program next checks to see if F was pressed. In that case, DL is returned to its original value of OG.

If none of the above are true, the program next looks to see if the space bar was set, changing the value of FLAG if it was. Finally, the routine sifts out any input that wasn't an arrow key, and allows the program to access one of four routines in lines

670 to 700 that change the X and Y coordinates appropriately.

Draft mode works similarly as far as cursor movement. However, no line is left by the moving cursor. Whenever the S key is pressed for the first time, that pixel is turned on to show the start position of the line to be drawn. That point is stored in X2 and Y2 as the coordinates to be used in the later LINE statement.

When the second point in the line is set (PO=2), then the line is drawn, in line 880, and the program waits for either another S, or an arrow key before proceeding. ▽

```

10 *****
20 ***
30 ** Sketch *
40 ***
50 *****
55 **** Instructions ****
60 CLS
   :PRINT
   :PRINT
70 PRINTTAB(12) "Instructions?"
80 PRINT
   :PRINTTAB(16) "(Y/N)"
90 AS=INKEYS
   :IF AS="" GOTO 90
100 IF AS="Y" OR AS="y" GOTO 110 ELSE GOTO 270
110 CLS
   :PRINT
   :PRINT
120 PRINTTAB(2) "You may use either Sketch or
   Drafting"
130 PRINTTAB(2) "modes. Sketch uses a moving line to"
140 PRINTTAB(2) "draw, while Draft draws lines
   between"
150 PRINTTAB(2) "two points you specify by
   hitting":CHR$(34); "S":CHR$(34); ":"
160 PRINT
   :PRINTTAB(1) "= Hit any key for Sketch instructions"
   ="
170 AS=INKEYS
   :IF AS="" GOTO 170
180 CLS
   :PRINT
190 PRINTTAB(12) "= Sketch =
200 PRINTTAB(13) "[KControls:]K"
210 PRINTTAB(2) "Arrow Keys - Change direction"
220 PRINTTAB(2) "Number keys - Slow down cursor"
230 PRINTTAB(2) CHR$(34); "F"; CHR$(34); " - Return to
   top speed"
240 PRINTTAB(2) "Space Bar - Toggle cursor F (ON)-
   (OFF)"
250 PRINT
   :PRINTTAB(11) "= Hit any key ="
260 AS=INKEYS
   :IF AS="" GOTO 260

```

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```

265 '*** Set Delay ***
270 CLS
    :PRINT
    :PRINT
280 PRINTTAB(6) "Enter speed desired:"
290 PRINT
300 PRINTTAB(6) "[K1]K FAST TO [K9]K SLOW"
310 AS=INKEY$
    :IF AS=""GOTO310
320 OG=VAL(AS)*10
    :IF OG<1GOTO310
330 DL=OG
335 '*** Choose Sketch or Draw Mode ***
340 CLS
    :PRINT
    :PRINT
350 PRINTTAB(4) "Do you want:"
360 PRINT
    :PRINTTAB(6) "[S]ketch mode"
370 PRINTTAB(6) "[D]raft mode"
380 AS=INKEY$
    :IF AS=""GOTO380
390 IF AS="S"ORAS="s"GOTO420
400 IF AS="D"ORAS="d"GOTO710
410 GOTO380
420 CLS
430 FORN=1TOVAL(RIGHT$(TIMES,2))
440 DM=RND(1)
450 NEXTN
460 X=239
    :Y=63
470 X1=INT(RND(X)*X)+1
    :Y1=INT(RND(X)*Y)+1
480 PSET(X1,Y1)
485 '*** Sketch Mode ***
490 AS=INKEY$
500 X1=X1+XD
    :IF X1>239THENX1=239
510 IF X1<0THENX1=0
520 Y1=Y1+YD
    :IF Y1>63THENY1=63
530 IF Y1<0THENY1=0
540 FORN=1TODL
    :NEXTN
550 IF FLAG<>1GOTO570
560 PSET(X1,Y1)
    :FORN=1TO100
    :NEXTN
    :PRESET(X1,Y1)
    :GOTO580
570 PSET(X1,Y1)
580 IF AS=""GOTO490
590 IF VAL(AS)<1GOTO610
600 DL=DL*VAL(AS)
610 IF AS="F"ORAS="f"THENDL=OG
620 A=ASC(AS)
630 IF A<>32GOTO650
640 IF FLAG=1THENFLAG=0ELSEFLAG=1
650 IF A<28ORA>31GOTO490
655 '*** Change direction of Cursor ***
660 ONA-27GOTO670,680,690,700
670 YD=0
    
```



```

:XD=1
:GOTO490
680 YD=0
:XD=-1
:GOTO490
690 XD=0
:YD=-1
:GOTO490
700 YD=1
:XD=0
:GOTO490
705 '*** Draft Mode ***
710 X1=40
:Y1=40
720 CLS
730 AS=INKEY$
740 X1=X1+XD
:IF X1>239 THEN X1=239
750 IF X1<0 THEN X1=0
760 Y1=Y1+YD
:IF Y1>63 THEN Y1=63
770 IF Y1<0 THEN Y1=0
780 FOR N=1 TO DL
:NEXT N
790 PSET(X1,Y1)
800 FOR N=1 TO 50
:NEXT N
810 PRESET(X1,Y1)
820 IF AS="" GOTO 730
830 IF AS="S" OR AS="s" GOTO 850
840 GOTO 990
845 '*** Set one point ***
850 PO=PO+1
860 PSET(X1,Y1)
870 IF PO=1 THEN X2=X1
:Y2=Y1
:GOTO 730
875 '*** Draw Line ***
880 LINE (X2,Y2)-(X1,Y1)
890 PO=0
900 AS=INKEY$
:IF AS="" GOTO 900
910 IF AS="S" OR AS="s" GOTO 950
920 A=ASC(AS)
930 IF A<28 OR A>31 GOTO 900
940 GOTO 980
950 PO=1
960 X2=X1
:Y2=Y1
970 GOTO 900
975 '*** Change Cursor Direction ***
980 ON A-27 GOTO 990,1000,1010,1020
990 YD=0:X1=X1+XD
:GOTO 730
1000 YD=0:X1=X1-1
:GOTO 730
1010 XD=0
:YD=-1
:GOTO 730
1020 YD=1
:XD=0
:GOTO 730

```

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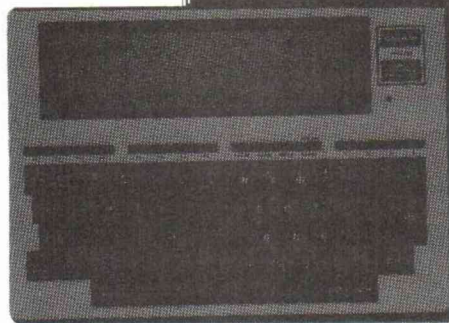
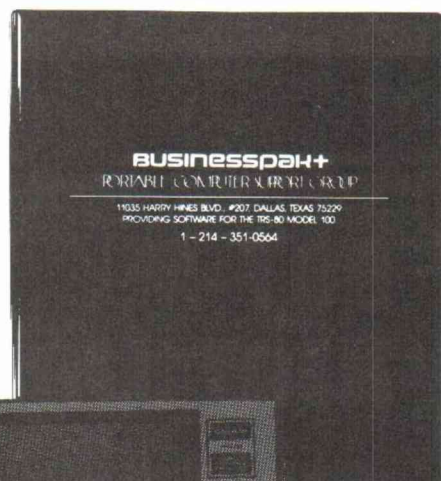


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FULL-DUPLEX



Editor's Note: Full-Duplex is dedicated to solving readers' Model 100 problems. Readers needing assistance should address their letters to Terry Kepner c/o Portable 100, 67 Elm St., Camden, ME 04843.

UPDATE ON PROBLEMS WITH MODEL 100 TALKING 12

Last month there was a question about the Model 100 not working with the Model 12. Well, Radio Shack has come up with a fix for that problem.

The resistors R91, R94, and R99, located just below the RS232 connector, are 2K ohm, which is a design safety feature to protect the Model 100 CMOS circuitry from outside (RS232 line) interference and possible damage. These three resistors' ratings are too high for the Model 12 (and some other computers) to drive its signals through to the Model 100. For operation with the Model 12 and those other computers the three resistors must be changed to 330 ohms. Radio Shack has issued instructions to all their repair technicians that this alteration is a mandatory change, and must be performed on every Model 100 that comes into the shop for repair.

You could perform the change yourself, if you're very good with a soldering iron. One technician I talked to told me to go ahead and do it myself if I wanted. He says it's so tricky (the parts are crammed very close together) that he would rather not do it.

UPDATE ON THE INFAMOUS CLOCK CHANGING PROBLEM

And in the previous month's column was a question about the

year suddenly changing without warning. According to Bill Walters, from Radio Shack, the problem is that the date information, and machine-code driver software, is stored in RAM and driven by the CPU clock interrupts.

When you're communicating over the modem or RS232, which are interrupt driven, and happen to be using high baud rates, the date driver software can be "fooled" into thinking the interrupt is meant for the date clock. This results in the year being incremented. At the moment, Radio Shack has no fix for the problem.

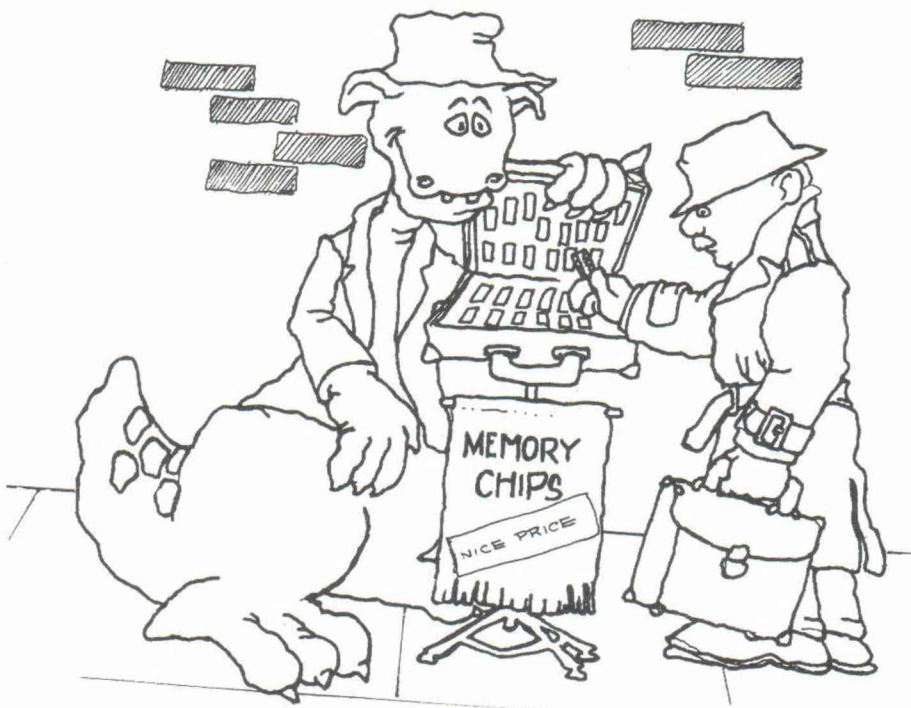
ALIEN RAM PRICED NICE AND EASY TO INSTALL

Two companies are now selling memory chips for the Radio Shack Model 100: Holmes Engi-

neering (5175 Green Pine Drive, Salt Lake City, UT, 84107, 801-261-5652) and Iota Systems (1690 Day Valley Rd., Aptos, CA, 95003, 408-684-0482). Holmes sells the chips for \$75 each, or two or more for \$70 each. Iota sells them for \$85 each, two or more for \$80 each. They're easy to install, but be very careful about static when installing them (see Scott Norman's article on page 34). Opening your Model 100 will void your Radio Shack warranty. I've read letters from customers of both companies, complimenting the firms on their fast delivery of the chips, and the ease with which they were installed.

ANOTHER EPISODE IN THE TAPE WOE SAGA

I travel a great deal and am having difficulty with cassette recorders. The Radio Shack CCR-81 is too



bulky, but the little tape recorders which use the microcassettes tapes don't seem to work too well. I can get them to save and load most Basic programs, but ASCII saves or text files always stop with an input-output error. What's the problem?

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▲ The difficulty with little tape recorders and the Model 100 is that

the recorders frequently don't have a motor, remote-control jack. This is required for ASCII and text files cassette operations.

When the Model 100 saves or loads an ASCII program, it uses the remote plug to stop the tape recorder motor after each line of the Basic program. If the Model 100 is saving the program, the time between the stopping of the tape recorder and the starting of the beginning of the next line is used to convert the Basic line in memory from its tokenized

form to ASCII. If it's loading the program, the time is used to convert the ASCII line to its tokenized form. As an indication of the time required to do this, just try saving or loading an ASCII file in RAM.

The problem with tape recorders which don't stop during text or ASCII file saves or loads is that the gap between the different blocks of lines throws off the Model 100's timing, and results in an input-output error.

If you're technically inclined, you could open up your tiny tape recorder and splice a sub-miniature jack into the recorder's motor powerline, jerry-rigging a remote control for the unit. *[There's also a modification you can make to your cassette lead. Paul Andreassen will tell you how to do it in next month's issue. —JPMjr.]*

The other choice is to look for a small tape recorder that has the remote-control jack in addition to the standard microphone and earphone jacks.

Another difficulty with these small micro-recorders is they were designed for low-quality voice storage, not critical 1500 baud computer data storage. The electronics in these recorders are inferior, on the average, to the normal, full sized units. I've seen several letters from people who've used various micro-recorders for Model 100 cassette data storage, and they've all had limited success.

One other choice is available:

Holmes Engineering (mentioned above) has released a wafer tape

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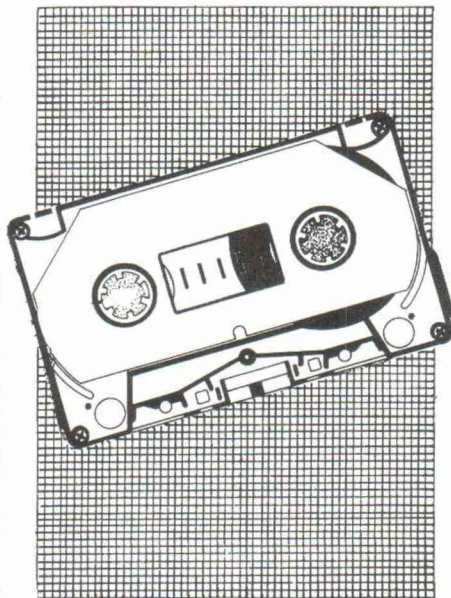
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KANGAROO VIDEO PRODUCTS INC.
WE SET THE STANDARD



drive for the Model 100 that uses endless loop tapes for storing data at high baud rates (about three to four thousand Baud). In concept the wafer drive system is a slow disk system, letting you save multiple files on one tape, with automatic fast-forward to skip unwanted files. The unit uses gel-cell batteries for long term battery life, and sells for \$299.50.

SCREEN CARE AND LUBRICANTS FOR MODEL 100

I've noticed that with all the use my Model 100 gets, the plastic screen cover gets pretty scratched. I use a plastic cleaner and polish that I use on my turntable cover and it works wonders in removing all those scratches. It's called "Audio Buff" and comes in two plastic squeeze bottles, a polish and a cleaner.

Also, each time I take the my 100 on the road, I plug and unplug the phone and cassette cables. By spraying the plugs with some electronic contact cleaner, they slide much easier. This is an alternative to spraying them with graphite, as has been suggested to me by other people. Graphite can conduct electricity and could interfere with the operation of the cassette and modem ports by shorting the pins of the connector together over the base of the connector, since it's almost impossible to spray only the individual pins.

Clean Contacts
Wolfboro, NH

Thanks for the suggestions. It certainly makes sense, since the audiophiles have been concerned about the appearance of their plastic dust covers for much longer than we Model 100 owners. And your point about using graphite is well taken.

TRYING TO GET 100 AND COCO TO TALK TOGETHER

I'm trying to get the Model 100 and my Color Computer to talk to one another. I'm using Colorcom/E as the terminal program on the Color Computer, with the Radio Shack 4-pin to DB25 connector cable, with

null modem plugged into the Model 100. What am I doing wrong?

Silence in Canton
Canton, NC

Boy, it seems a lot of Model 100 owners have a Color Computer, or know friends who do.

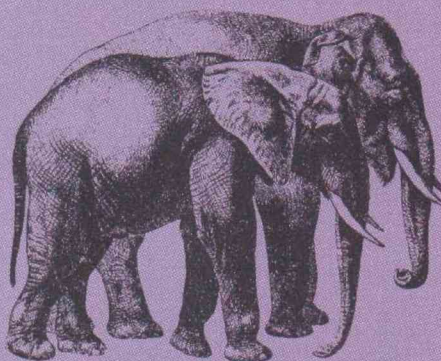
First, assuming the null modem and RS232 cable are not the problem, set Colorcom/E to match the Model 100 terminal settings. Make sure both use the same word size, parity (enabled or disabled), and

stop bits. To upload to the Color Computer, set the terminal status to 3711E. To download, set stat to 3711D. Colorcom/E should be set from command mode (L), using this sequence: baud rate - 2 (300); parity - 2 (ignore); data bits - 1 (seven); delay after carriage return - 2 (extended); linefeed - 2 (insert after carriage return); and other control characters - 1 (strip). Colorcom/E assumes you always want one stop bit when data communicating.

To do an upload, restart Color-

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com/E (to clear out the buffer), put the 100 in terminal mode, press CTRL-R (to tell Colorcom/E a file is about to be sent and to capture it), select up (F3) in term, type the file name to transmit, press enter (null) in response to the width prompt, and watch the file transfer. When the transfer is finished, press CTRL-T to close the Colorcom/E buffer. Now save the file from your Colorcom/E buffer to tape or disk, depending on which version you have.

Going the other way, set the Model 100 to the proper stat settings, go to term, press down (F2), and give the name of the file you want to put in memory. On the Color Computer, restart Colorcom/E to clear the buffer, load the file to be transferred into the buffer, and press Control-2 (control key is the down arrow). When the file finishes transferring, press down on the Model 100 to stop storing the file.

Another way to transfer a program or data file to the Model 100 is to use the Color Computer without a terminal program. Configure the Model 100 as 48N2E, go to term mode, press down (F2), and give the file name to be used in RAM. On the

Color Computer, if the file is a program, just type LLIST. If it's a data file use a simple for-next loop to read the data into a variable, from tape or disk, and PRINT#-2 to send it to the Model 100. This method still requires that you use the null modem between the Color Computer and the Model 100.

WILL X-RAYS AIMED AT TERRORISTS HURT 100?

I'm planning on doing a lot of flying in the near future and I was wondering if the x-ray machines at the airport can damage the Model 100 or the programs stored in it?

Grounded
Memphis, TN

▲ The x-ray machines at airports are low power, pulsed devices. The levels used are too low to cause any physical damage to the Model 100. (If it did cause damage, the machine would also have fried the operator, microwave oven style.) The memory is also rather insensitive to the x-ray radiation. To change memory re-

quires applying electrical current to the memory cell in question. The x-ray machines use magnetic fields to generate the x-rays. These magnetic fields induce an electrical current in the Model 100, but it is so small that the chips don't notice it. Cassette tapes, on the other hand, use tiny particles of magnetic sensitive material to store data. The field generated by an x-ray machine is supposed to be too small to cause any problems, but repeated trips through dozens of machines will have a cumulative effect on the data stored.

Anyway, you might as well just carry the computer by hand, since the guards would insist on inspecting your luggage, or briefcase, when they see the large metallic footprint left by the Model 100. For data safety, also hand-carry your data tapes.

PRINT-USING BUG CREATES UNWANTED MINUSES

There is a bug in PRINT USING. The problem occurs when using a minus sign in front of the number signs in the format field. The minus sign always prints, regardless of the sign of the argument. For example, 'PRINTUSING " - ####";34' prints "-34", and 'PRINTUSING "- ####";34' prints "-34"! The other method of specifying numeric sign, putting the minus sign after the number signs, i.e.; 'PRINTUSING "####-";34', prints the minus sign after the negative number printed, which is correct for that format. A kludge method of fixing it is to include room in the number sign, but this isn't always possible (###.##-###.## isn't any good if you're cramped for space) and in some applications, it would be better if the sign were in front of the number instead of after it.

Put Out
Beaverton, OR

▲ You're right. That is a bug. According to the manual, pages 170-172, that placement of the minus sign in front of the number signs should only be printed if the number is negative, not all the time. Thanks for bringing the bug to our attention. ♣

THE 100 BECOMES A SILENT BOARD MEMBER

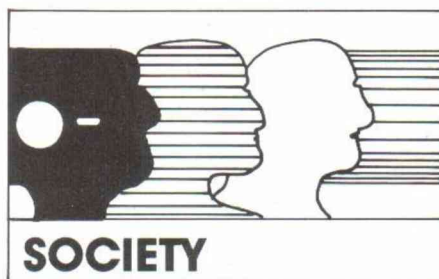
A public man uses his 100 to hold a silent meeting in the middle of a public gathering.

By DAVID HUGHES

Like most innovative uses of micros, opportunity, coupled with need, produces more progress than all the market research ever done. Give people new tools, and they will build structures undreamed of by the tool makers. If micro manufacturers thought more about that than trying to duplicate the ways people have produced, manipulated, and communicated "information" in the past, we would move more rapidly into the Information Age.

A little incident involving one of life's biggest frustrations for busy people — waiting for their item to come up on the agenda at an interminable public meeting — led to a spontaneous use of the Model 100 to hold a "silent board meeting" that has lots of reverberating possibilities. I guess it occurred to me on the spot because I have so thoroughly "internalized" micros and networks into my life, work, and thought processes over the past six years that it seemed obvious at the time. Others hearing about it seemed surprised and have urged me to share the idea with you.

COUNCIL MEETING. It happened one night at a city council meeting in Manitou Springs, CO. The board of directors of our small business association there had to meet with the council in their chambers at a regularly scheduled meeting to discuss an economic development agree-



ment. As spokesman for the board, I had my Model 100 with me with my notes in a file to call up as a "teleprompter" and to stroke down (I don't "jot" anymore) questions, comments, and decisions as they were made at the meeting.

But our busy board members hadn't had time to meet before the meeting. We just all ended up in the audience. If we talked aloud we would have disturbed the meeting. We didn't want to go outside and huddle because some of the other agenda items were of interest to other board members. So I created a new file, entered a question on my mind, and passed it to the secretary of the board. She read it, answered, passed the 100 to the Main Street manager for her comments. Then it went to the president, and back and forth until, within about 30 minutes, while the council droned on, we had held, in effect, a "silent board meeting." With a complete transcript to boot!

When our item came up, never

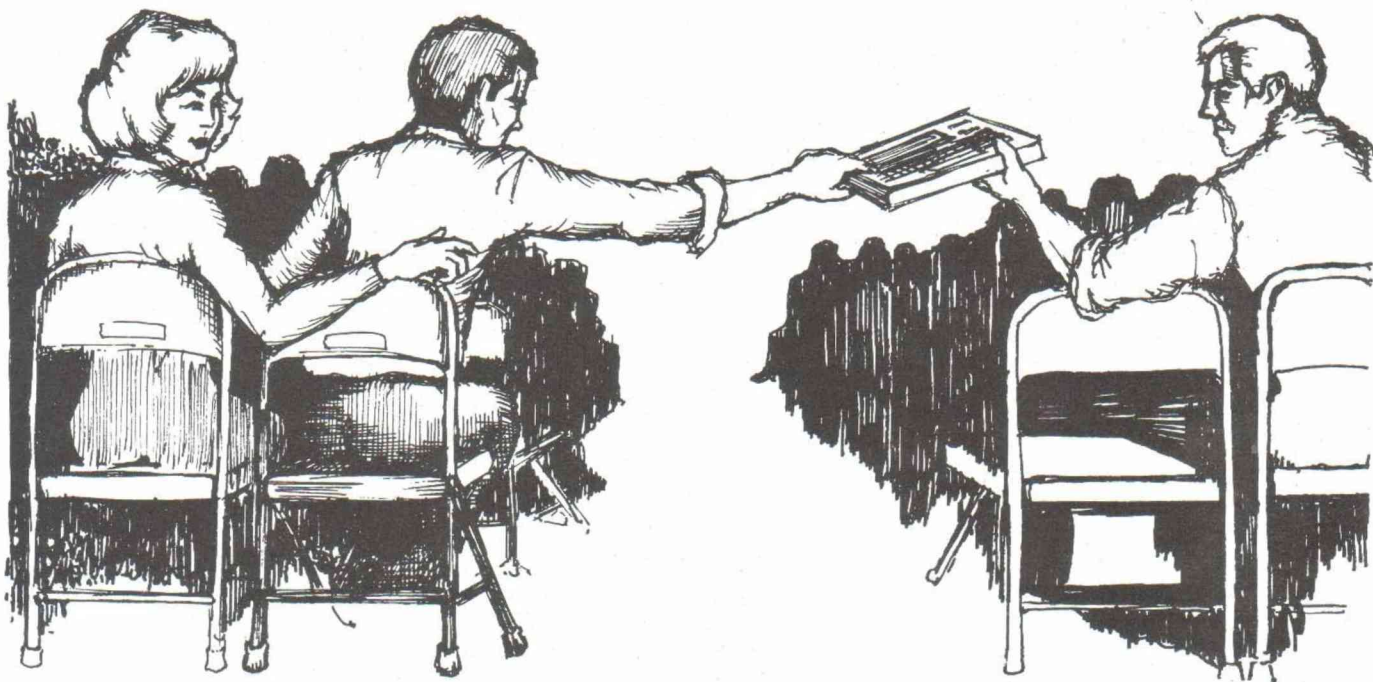
having uttered a word out loud, we had our act together. And of course won our points — out loud. But several councilmen kept looking at the little buff and black box I was using for my notes and wondering what sort of magic I had in there.

PASS THE MICRO. Since then I have used the technique of "passing the micro" in many situations. What is your name and telephone number again? Here, *you* enter it in my 100. You can spell your name better than I can. Who is at this meeting? Pass the micro, not a yellow pad. Got questions? Stroke'em down and pass'em to the moderator, or president, who can pass them to the answerer. With all the superior brevity and specificity of the written, rather than spoken, word.

Then in a presentation I was making one day to a group of about 100 people at the Industries of Jefferson County luncheon, I noticed they had everybody introduce themselves by standing up before I as the guest speaker came on. Since I wanted to address every professional component there — business, government, cultural, civic. I sat at the head table with my 100 and stroked down the generic affiliations of all the groups there.


I don't have a memory for names good enough to stand up at a meeting and make all the acknowledgements I should. Up to now.

VALUE TO ALL. But in this case I was able to go even further. I wanted to make a point that micros and networks would be of value to *all* the groups represented. I had an Osborne I with its video port hooked to a projection TV with an 8-foot screen for demonstration purposes. After having made my introductory remarks and rendering, error-free, all the courtesy acknowledgements from the screen of my 100 at the podium, I then carried it over to the Oz, booted up a terminal program, hooked the 100 via an RS232 cable to the Osborne, and, at 1200 baud "uploaded" my list I had taken down at the head table. Of course everybody in the room could see my "instant" illustrative list. My point was better made than if I rattled it off orally.



It occurred to me I could have passed the 100 around the room and had people hold their "silent meeting" and enter "written" questions for me. When the 100 returned to

me, I could have displayed the questions on the screen before answering them. But then I wouldn't have had the use of the 100 as my speaking note pad. Hmm. Looks like I better

buy a second Model 100 for meetings... Meanwhile, would you please pass the Model 100 with the salad dressing down to this end of the table? 

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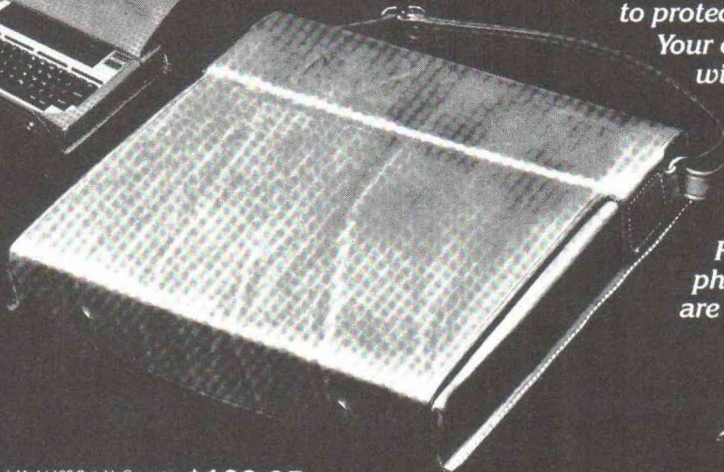
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NEW PRODUCTS



REDUCE GLARE BY PROPPING YOUR MEWS

Bothered by the glare off your LCD?

That glare can be reduced by propping the Model 100 up at an angle. That effect has been achieved by an editor of a well-known magazine dedicated to the 100 by sticking sawed-off pencils into the screw holes under the machine.

However, two new products offer a more elegant solution to this problem.

P-Legs — manufactured by KJM Development, P.O. Box 698, West Hartford, CT 06107 — are plastic legs with rubber tips that fit into the 100's screw holes allowing the micro to be perched on a desk at a comfortable angle. A pair of P-Legs cost \$3.50 plus 70 cents shipping and handling.

The PoCo stand — manufactured by Diskus Products, 6003 Bandini Blvd., Los Angeles, CA 90040 — is a stand made of curved, smoked plastic that will support your 100 at about a 30 degree angle to your desk. It costs \$17.95, plus \$2 shipping and handling.

ASSEMBLER LETS YOU WRITE 8085 CODE

Custom Software, 605 North C, #2, Wellington, KS 67152, is offering an 8085 assembler for the Model 100 for \$22.95. It is written in Basic and needs at least a 16K RAM.

According to Custom, its assembler, ASMBLR.BA, uses the 100's TEXT program to write its assembly programs. That, Custom said, makes it possible to use all the built in features of the Model 100 and frees you from the task of learning different editing commands.

For long programs (or little ram space), the assembly language program can be transferred to tape before assembly. ASMBLR.BA reads the source program one byte at a time and doesn't store more than one line in memory at any given moment. This solves the problem of not having enough ram space for both the source code and the assembled object code.

ASMBLR.BA supports the following pseudo operations:

- DEFM, define a message or string of text;
- DEFB, define a byte of memory space;
- DEFW, define 2 bytes of memory space;
- DEFS, set aside a block of memory;
- EQU, equate or equals;
- \$, meaning current location;
- ORG, starting address of program; and
- END, ending address of program and program entry point.

Several "switches" can be set to allow a variety of different methods of assembly. The assembled program can be output to your line printer. You have the choice of assembling the program but not writing the object file. You can also suppress the output of the symbol table.

ASMBLR.BA is available on tape or disk. The disk version comes on a Model III compatible disk with a machine-language file transfer utility that supports file transfers between the Model III and Model 100 at 19,200 baud.

MOVE OVER CASSETTES! WAFERS ARE HERE!

Holmes Engineering Inc., 5175 Greenpine Drive, Murray, UT 84123, has become the first company to offer an alternative storage

system for the Model 100 for \$349.50.

Holmes Engineering has released its PMD-100 portable high speed wafer tape drive for the TRS-80 Model 100 computer.

According to information from Holmes, the PMD-100 records Model 100 text files and programs at high speed on miniature tape cartridges called "wafers" (formerly called "stringy floppies"). An 8K file, the company said, typically loads or saves in less than 10 seconds.

To give you an idea of how Holmes's product works, here's the operating procedure outlined by the company:

- Plug the PMD-100's RS-232 connector into the Model 100.
- Turn on the Model 100 and the PMD-100.
- Place your Model 100 in the TEL-COM mode.
- Enter the correct STAT, as outlined in the PMD-100 manual — a simple operation which tells the Model 100 to "talk" to the PMD-100 via the RS-232 at 9600 baud.
- Using the download function, you load the PMD-100 operating system from the PMD-100 to the Model 100. Once the operating system is in the 100, you can leave it there as you would any other program.
- From the 100's main menu, move the cursor over the wafer drive's operating system and enter the program. A new menu will appear on the screen.
- This menu lets you save or load programs or text files, read the directory of a tape, or determine how much free space is left on a tape. Files are stored and retrieved by the same file names used by the Model 100.

The PMD-100 is approximately 8 inches wide, 6 inches deep, and 2½ inches high. It weighs just under four pounds.

The wafers for the PMD-100 are about the size of a business card and ⅛-inches thick. It contains a loop of

tape from 5 to 100 feet long, wound around a open-faced spool. The tape is inserted in the opening of the drive mechanism just as you would insert a cassette in your car stereo. The tape is capstan driven at a speed of about 7 inches per second.

The drive contains a Z-80 micro-processor, 16K RAM, and 4K ROM.

It is powered by a rechargeable battery or AC wall pack. Between operations, the drive automatically powers down. A cable to power the Model 100 from the PMD is included.

The front of the PMD-100 contains:

- An opening to insert wafer tape cartridges;
- A power ON/OFF switch;
- Jacks and connectors for the battery charger, Model 100 power cable, and the coiled RS-232 cable;
- Low battery indicator;
- Indicator to show when the battery is fully charged;
- Power on indicator; and
- Write indicator.

The Holmes wafer drive comes with:


- 3 assorted wafer tapes;
- AC adaptor/battery charger;
- Cable to power the Model 100 from the PMD;
- Instruction manual; and
- Membership in the PMD user's group, which allows you to submit, purchase, and exchange programs on wafer tape.



KANGAROO CHIP-TOTE CASE FOR MODEL 100

Chip-Tote is a carrying case for the Model 100 and Epson HX-20 that doubles as a desk.

Made by Kangaroo Video Products Inc. of 9190 Manor Drive, La Mesa, CA 92041, Chip-Tote features a slim, fully foam-padded de-

sign opening up into a one-piece work station. A stand-up utility top holds papers upright for reference. Inner pockets can be used to store notebooks and notepads. A zippered pouch holds the 100's AC adapter, phone cord, and extra batteries. Made of DuPont Cordura nylon, the case comes in black or smoke gray and has an adjustable shoulder strap and a hand strap. Chip-Tote costs \$59.95. 

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END TRANSMISSION



EXCITING POTENTIAL IN TELELEARNING'S NETWORK UNIVERSITY

Another potentially positive pinnacle has been staked out by microcomputer entrepreneurs—the electronic university.

TeleLearning Systems of San Francisco's held a press conference in Washington, DC, to announce a totally new approach to high-level education [for a related story see *The Wire*]. In attendance, among others, was T.H. Bell, President Reagan's Secretary of Education.

In a nutshell the concept is this: Students can conveniently attend university classes at home by telecommunicating with professors by microcomputer and modem. There will be no physical university in existence, other than the mainframes and other administrative buildings necessary to maintain the school.

BIG PHONE BILLS. Like the students, professors would teach their courses from their homes. There would be no need for expensive classroom items such as blackboards, desks, podiums, and other niceties that make attending college more expensive. Of course there will be a larger phone bill. But if the parameters of the school are established correctly, students should be able to spend a minimum amount of time on-line by connecting to the school only to down-and upload assignments and instructors' comments.

The electronic university should make the cost of education affordable to more people than traditional methods. With no need to pay for room and board, transportation and other peripheral expenses, students forced to go to schools near home,

even though the course offerings are not to their liking, will have more options.

There are drawbacks; potentially many, the most negative of which is that the promoters of TeleLearning U could design the school to be no better than a matchbook correspondence school, "Become a nuclear physicist in 10 weekly lessons!" I suspect, and hope, they have more serious plans for their project. Imagine being able to earn a medical degree from your kitchen table? That's an exciting possibility.

NO BEER BLASTS. Most of the other drawbacks are socially oriented. There can be no Friday Night Beer Bashes, no student government meetings, no Greek houses (or maybe there can, Phi Chippa Null), no campus radio station, and other social learning activities. One of the most beneficial aspects to going

away to school is, that for many students, it's their first time living away from their parents. And although for many they are far from independent from their parents, it is their first step out into the real world.

The success of on-line learning centers will depend on the people who run the schools. It will offer opportunities to people looking for education as a way to change careers. It should bring the pricetag of education dramatically downward. It can do a lot to improve, and make more universal, American education.

TeleLearning's first offerings are available for Apple II and IBM PC users. It will soon be available, according to a recent InfoWorld article, for Atari and TRS-80 Model III owners. It's inevitable that TeleLearning will catch on to the possibilities of portables and realize that there is no reason to stop at going to school from a student's kitchen. With portables, students will be able to go to school from virtually anywhere. ♣

NEXT 100

While you're saving your pennies for a Holmes wafer drive, you may be wishing you could use a shirt-pocket recorder for cassette storage with your 100. Although the audio quality of those recorders is notoriously bad, Paul Andreasen will explain next month how to modify your cassette lead to work with recorders without a remote jack.

Also next month, Richard

Ramella showed you how to create still life with his Sketch Pad. Next, he'll show you how to animate your drawings.

In addition, Bill Walters will be delving into the 100's ROM, and J. Gary Bender will be initiating a series on how to be a better programmer; so join us next month and start your new year with *Portable 100*. ♣

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So far so good.

Next, sophisticated performance demanded versatility. A wide choice of character sets, a buffer expandable to 8K, and the ability to interface with all popular personal computers. We added macro

instruction, giving Gemini-10X the capability to perform up to 16 operations with one command. We included as standard a paper feed system that has a friction and fully adjustable tractor feed. Then we even built in the dexterity to print graphics and text on the same line.

Done.

And, of course, staying the best means constant reviewing and fine-tuning. Keeping the Gemini easy to find, easy to afford and so reliable it can be warranted for up to twice as long as its major competitors.

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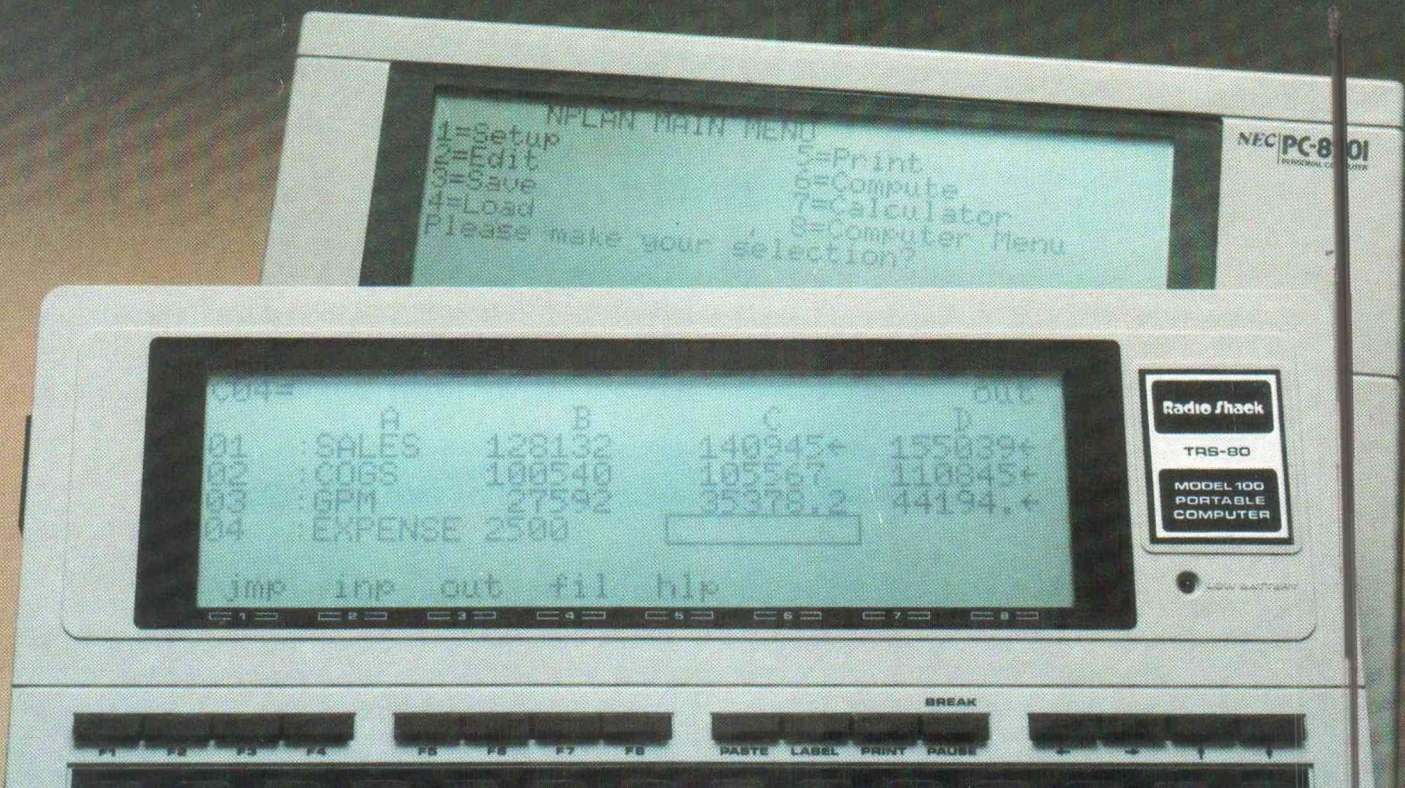


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